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Contents

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Back issues: Vol. 1 (1987-1990), Vol. 2 (1990-1992), Vol. 3 (1992-1993), Vol. 4 (1994-1996), Vol. 5 (1996-1997), Vol. 6 (1998-2000), Vol. 7 (2000-2001), Vol. 8 (2002-2003), Vol. 9 (2004-2005), Vol. 10 (2006-2007), Vol. 11 (2008-2009), Vol. 12 (2010-2011), Vol. 13 (2012-2013), Vol. 14 (2014-2015), Vol. 15 (2016-2017), Vol. 16 (2018-2019), Vol. 17 (2019-2021).
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A new species of *Leiurus* Ehrenberg (Scorpiones: Buthidae) from Nigeria, with extension of the distribution range of the genus to the Southwestern portion of the African continent

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Abstract

One more African new species belonging to the genus *Leiurus* Ehrenberg is described. The description is based on two pre-adult male specimens collected in the region of Kaura Namoda, NW of Nigeria. The new species shows affinities with other *Leiurus* species distributed in the Western portion of Africa; however several characteristics attest that this population is certainly distinct. The ecological features of the type locality are particular since the area is characterised by savannah-like vegetation, instead of arid-desert formations; formation previously defined exclusively for *Leiurus savanicola* described from Cameroon. The type locality of the new species is the most Southwestern region of Africa in which a *Leiurus* species was collected.

Keywords: Scorpion, systematics, *Leiurus*, savannah-like vegetation, Nigeria, Africa.

Introduction

In several previous publications produced ten to twenty years ago it was emphasized that the number of new species of *Leiurus* present in the African continent could be expected to increase rapidly (Lourenço *et al.*, 2002, 2006). This was confirmed in more recent publications when the number of *Leiurus* described from Africa knew a remarkable improvement (Lourenço, 2019, 2020a,b; Lourenço & El-Hennawy, 2021; Lourenço *et al.*, 2018). This new situation was possible partially due to new collecting but in several cases also to the existence of old specimens available in collections such as that of the Muséum in Paris, but not previously studied. For more precise details a recent

synopsis is available in Lourenço (2020a). In many, if not most cases these more or less 'old' specimens were collected in regions which are no longer attainable in present days, mainly due to security reasons (Lourenço, 2020a,b). Most historical aspects concerning the genus *Leiurus* were largely treated in an important number of recent publications and consequently will not be further discussed here (Lourenço, 2019, 2020a,b; Lourenço & El-Hennawy, 2021). In this contribution, attention is given to two specimens collected a half century ago in Nigeria. Until that date it was assumed that only the classical species *Leiurus quinquestriatus* (Ehrenberg, 1828) was present in Africa, and in particular in zones closed to the Nigerian site such as the Hoggar and Tassili N'Ajjer in Algeria or the Aïr (Azben) Massif in Niger (Vachon, 1950, 1952, 1958). Recently the status of the Hoggar population was clarified and a new species was described (Lourenço *et al.*, 2018). The precise status of the populations cited for the Tassili N'Ajjer in Algeria and the Aïr Massif in Niger (Vachon, 1950, 1958) remain yet unclear since no fresh material become available for study and the old material examined by Vachon (1950, 1958), was not located in the collections in Paris. The Nigerian location represents a totally new record for a *Leiurus* and the first one for this country. Since the specimens present some morphological differences in relation to other recently described species and in account of the markedly distinct habitat in which they were collected, a new species is presently described.

Methods

Illustrations and measurements were obtained using a Wild M5 stereo-microscope with a drawing tube and ocular micrometre. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Vachon (1952) and Hjelle (1990).

Taxonomic treatment

Family Buthidae C.L. Koch, 1837
Genus *Leiurus* Ehrenberg, 1828
Leiurus nigerianus sp. n. (Figs. 1-10)

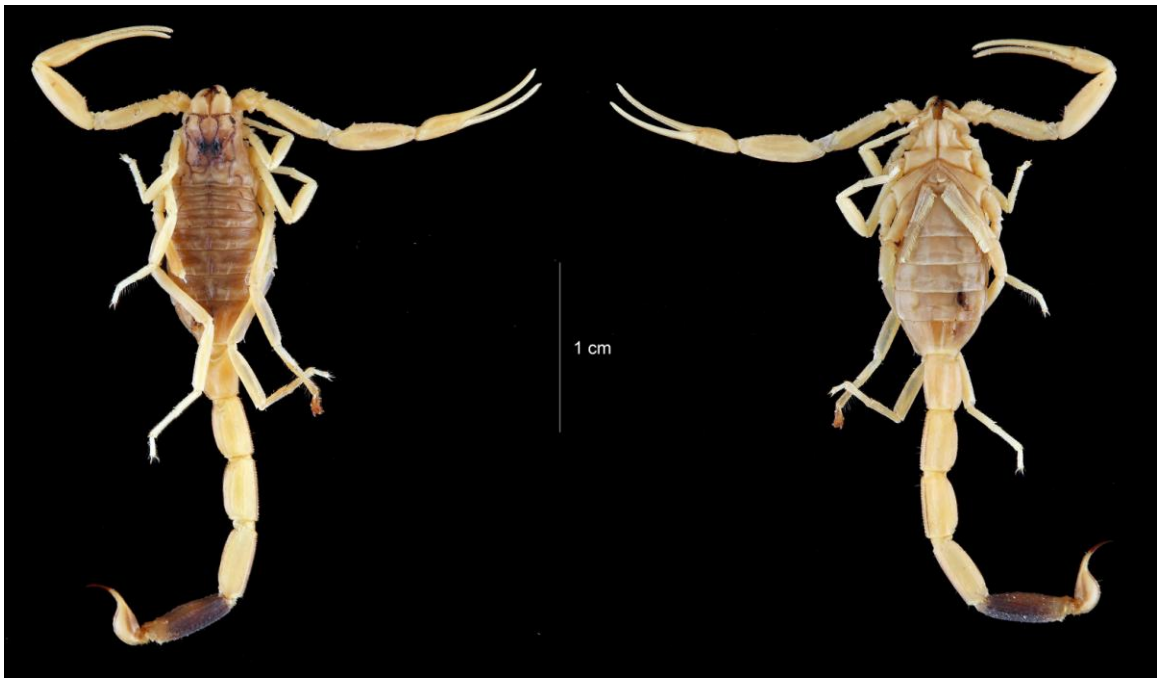
Type material: Nigeria, SW Kaura Namoda, IV/1971 (H. Lhote leg.), in savannah-like vegetation, under log. 1 male holotype and 1 male paratype. Both holotype and paratype are juveniles or pre-adults. Type material is deposited in the Muséum national d'Histoire naturelle, Paris.

Etymology: specific name refers to the country, Nigeria, where the new species was found.

Diagnosis: The male holotype has a total length of 39.7 mm (the paratype is poorly preserved but shows a similar size). Based on the theoretical morphometric growth factor for arthropods defined by Dyar (1890) and Przibram & Megusâr (1912), and in account of the average size of adult *Leiurus* species, it is possible to suggest that the described specimens are third or fourth instar juveniles, and possibly pre-adults. This is excluding the pro-juvenile instar and counting only juvenile instars from I to V or VI.

Ground colour yellow to pale yellow for both the body and appendages; ventral carinae of metasomal segments slightly spotted; segment V more heavily spotted with blackish. Carapace only moderately spotted mainly in its central zone forming an almost inverted triangle. Ocular tubercle moderately prominent. Pectines with 35-35 and 32-33 teeth respectively for holotype and paratype. Median carinae on sternite III practically

absent; on sternite IV vestigial; sternite VII with mediate intercarinal surface almost without granulations. Pedipalp fingers with 11-12 rows of granules. Telson with a long aculeus, with a similar length to that of vesicle; weakly curved. Dorsal trichobothrium of femur, $\mathbf{d_4}$ in the same position of external trichobothrium $\mathbf{e_1}$, Fixed finger trichobothrium **db** in a distal position in relation to **est**. The global trichobothrial pattern of the new species is rather similar to that of other *Leiurus* species from Occidental Africa.



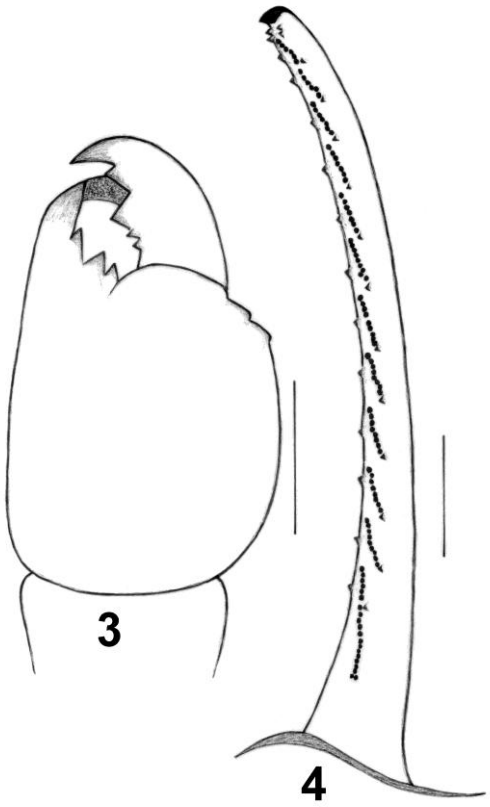
Figs. 1-2. *Leiurus nigerianus* sp. n. Male holotype. Habitus, dorsal and ventral aspects.

Description based on holotype and paratype. Morphometric values presented after the description.

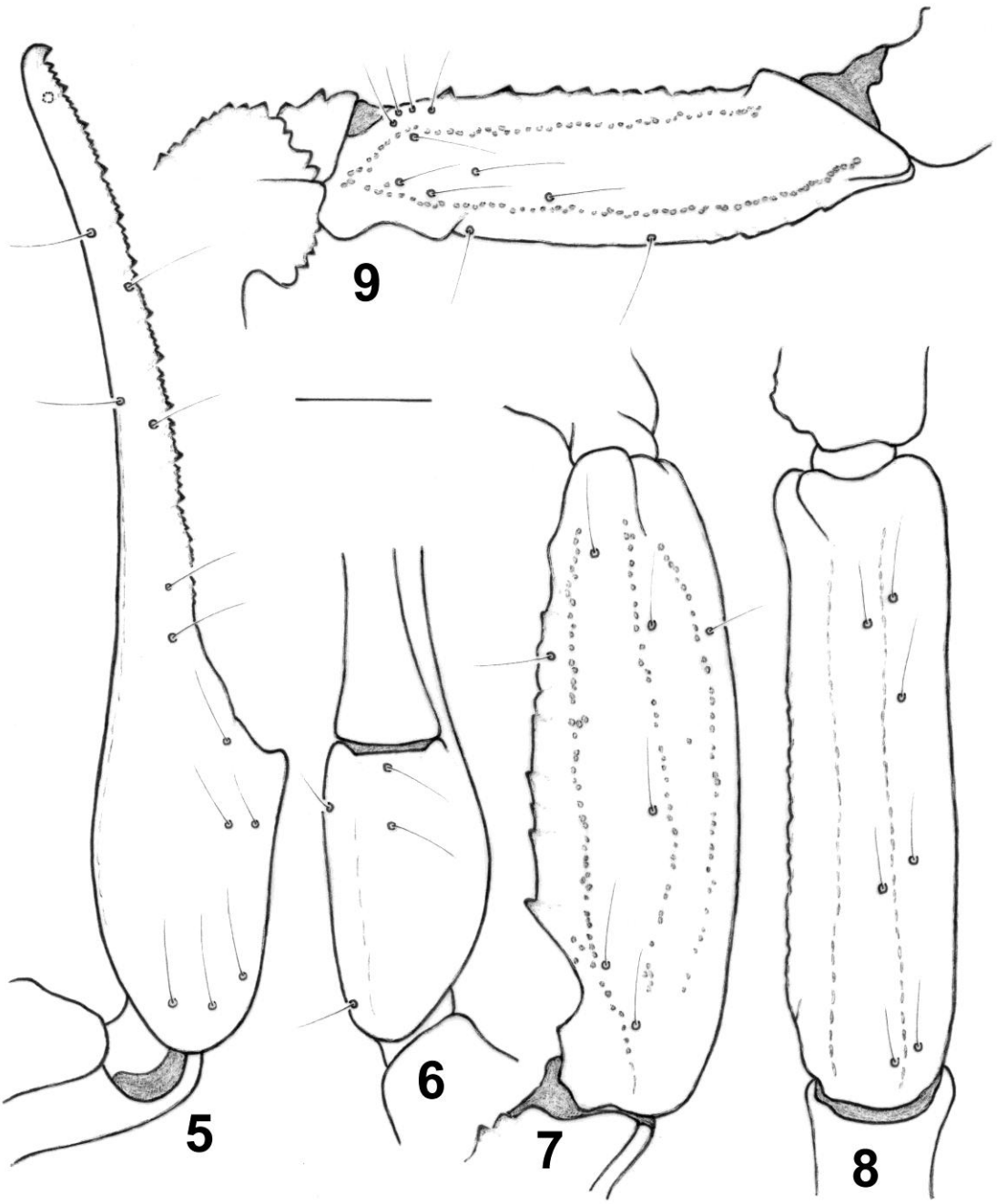
Colouration. Ground colour yellow to pale yellow; pedipalps and legs totally pale yellow. Carapace pale yellow with an almost inverted triangle in its central zone; eyes blackish. Mesosoma yellow without any infuscations on tergites I to VI. Metasomal segments I to IV pale yellow with some vestigial blackish spots over ventral carinae; segment V spotted with blackish. Vesicle pale yellow with the aculeus yellow at the base and red at its extremity. Venter globally pale yellow. Chelicerae pale yellow without any reticulated spots; teeth reddish. Pedipalps pale yellow overall except for the rows of granules on chela fingers which are slightly reddish. Legs pale yellow.

Morphology. Prosoma: The anterior margin of carapace with a weak concavity. Carapace carinae moderately to strongly developed; central median carinae moderate; anterior median carinae moderate to strong; central lateral weak; posterior median and posterior lateral carinae moderate, terminating distally in a very small spinoid process that extends slightly beyond the posterior margin of the carapace. Intercarinal spaces with very few irregular granules, and most of the surface almost smooth, in particular laterally and posteriorly. Median ocular tubercle anterior to the centre of the carapace and moderately prominent; median eyes large in size and separated by about one and half ocular diameters; three pairs of lateral eyes observed; a possible fourth pair of extremely reduced eyes may be present. Mesosomal tergites I and II pentacarinate; III and VI tricarinate. All carinae moderate to strong, terminating distally in a spinoid process that extends slightly beyond the posterior margin of the tergite. Median carinae on I moderate,

on II-VI moderate to strong. Tergite VII pentacarinate, with lateral pairs of carinae moderate to strong and fused; median carinae present on the proximal half, moderate to strong. Intercarinal spaces weakly granular. Lateral carinae practically absent on sternite III; weak to vestigial on sternites IV to VI; moderate on VII; median carinae on sternites III and IV weak to absent. Pectines moderately long; pectinal tooth count 35-35 (32-33); Metasomal segments I and II with ten carinae, moderately crenulate; lateral inframedian carinae on I complete; on II represented in its posterior zone by a few granules; III and IV with eight carinae. Dorsal and dorsolateral carinae moderate, without any enlarged denticles distally. All the other carinae moderate to weak on segments I to IV. Segment V with five carinae; ventromedian carinae with several spinoid to lobate granules distally; anal arch with three slightly spinoid lobes. Dorsal furrows of all segments weakly developed and smooth; intercarinal spaces almost smooth, with only a few granules on the ventral surface of segment V. Telson smooth; subaculear tubercle absent; aculeus with a similar length to that of vesicle; weakly curved. Chelicerae with two denticles at the base of the movable finger (Vachon, 1963). Pedipalps: Trichobothrial pattern orthobothriotaxic, type A (Vachon, 1974); dorsal trichobothria of femur in β (beta) configuration (Vachon, 1975). Dorsal trichobothrium of femur, $\mathbf{d_4}$ in the same position of external trichobothrium $\mathbf{e_1}$, Fixed finger trichobothrium **db** in a distal position in relation to **est**. Femur pentacarinate; all carinae moderately crenulate. Patella with seven carinae; all carinae moderately to weakly crenulate; dorsointernal carinae with 3-4 small spinoid granules. Chelae slender, with elongated fingers, smooth and without carinae. Dentate margins of fixed and movable fingers composed of 11-12 almost linear rows of granules. Legs: Ventral aspect of tarsi with short spiniform setae more or less arranged in two rows. Tibial spurs present on legs III and IV, moderately marked. Pedal spurs present on all legs, moderately marked.



Figs. 3-4. *Leiurus nigerianus* sp. n. Male holotype. 3. Chelicera, dorsal aspect. 4. Cutting edge of movable finger showing rows of granules (Scale bars: 1 mm).



Figs. 5-9. *Leiurus nigerianus* sp. n. Male holotype. Trichobothrial pattern. 5-6. Chela, dorso-external and ventral aspects. 7-8. Patella, dorsal and external aspects. 9. Femur, dorsal aspect (Scale bar: 1 mm).

Morphometric values of the male holotype of *Leiurus nigerianus* sp. n. Total length including the telson, 39.7. Carapace: length 4.4; anterior width 3.2; posterior width 5.2. Mesosoma length: 9.8. Metasomal segments. I: length 3.2, width 2.5; II: length 3.8, width 2.3; III: length 4.0, width 2.0; IV: length 4.4, width 1.9; V: length, 5.4, width 1.9, depth 1.8. Telson length 4.7; vesicle: width 1.7, depth 1.6. Pedipalp: femur length 4.6, width 1.3; patella length 5.4, width 1.7; chela length 8.4, width 1.4, depth 1.3. Movable finger length 6.1.

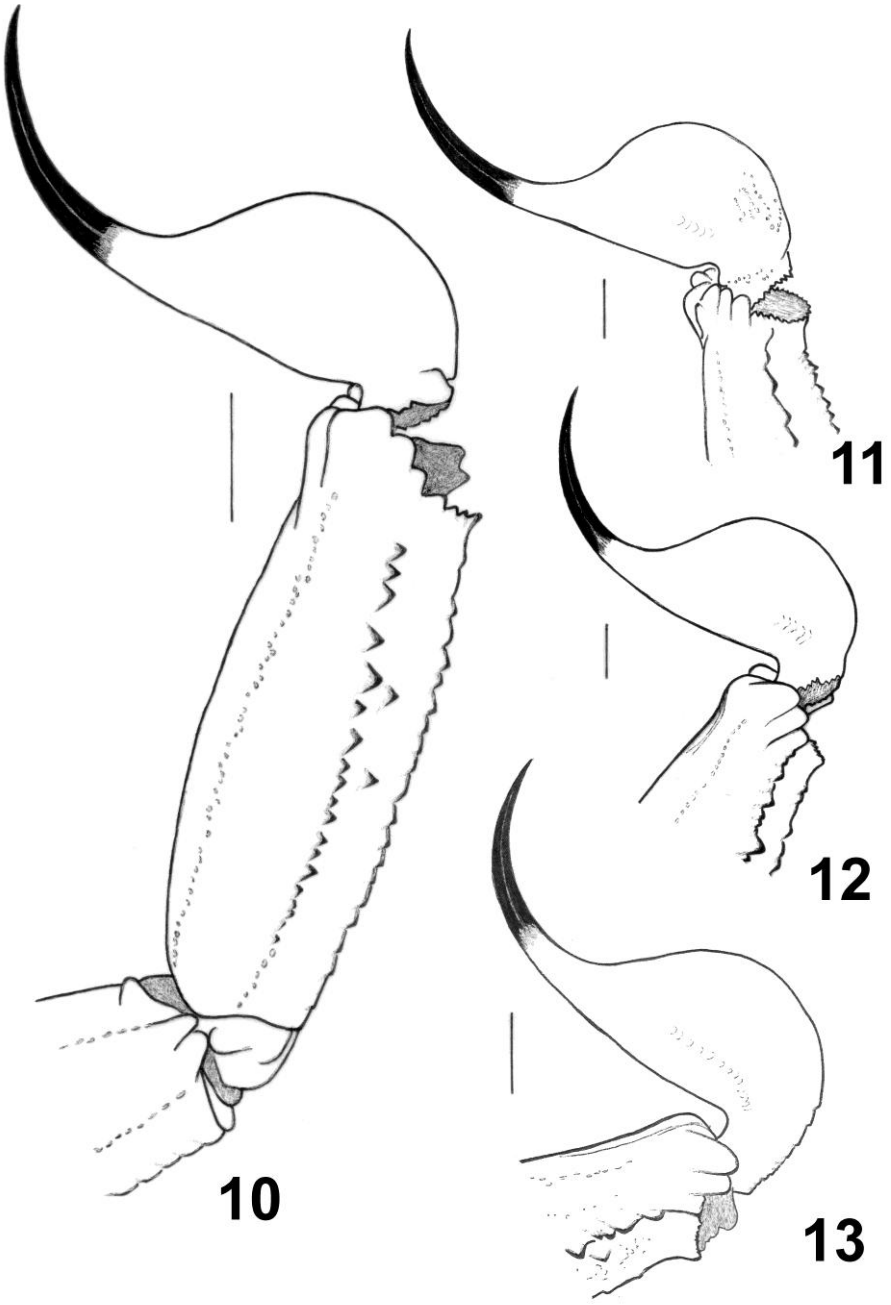


Fig. 10. *Leiurus nigerianus* sp. n. Male holotype. Metasomal segment V and telson, lateral aspect. Figs. 11-13. Telsons of *L. dekeyseri*, female holotype, *L. hoggarensis,* male holotype and *L. saharicus* male holotype (Scale bars: 1 mm).

Relationships. Taking in account both the geographical location and type of habitat of the new species, it should show affinities with *Leiurus savanicola* Lourenço, Qi & Cloudsley-Thompson, 2006 species described from a zone of Sahel/Savannah transition area in the North of Cameroon. Nevertheless, this is not the case since both species clearly differ by their colouration patterns; pale yellow in the new species, but almost totally dark brown (Fig. 14) in *L. savanicola*. In fact, the new species seems to have more characters in common with other species described from arid and desert zones, located more to the North, such as *Leiurus hoggarensis* Lourenço, Kourim & Sadine, 2018 from Hoggar, *Leiurus dekeyseri* Lourenço, 2020 from Mauritania and *Leiurus saharicus* Lourenço, 2020 from Mali (Figs. 11-13). The new species differs nevertheless

by a number of characters: (i) a very pale colouration, globally yellow, (ii) median carinae on sternite III absent, (iii) 11-12 rows of granules on pedipalps fingers, (iv) anterior margin of carapace with a weak concavity, (v) apparently only three pairs of lateral eyes, (vi) aculeus weakly curved.

More important are the characteristics of the habitat in which the new species was found, basically composed of West Sudanian Savannas (see ecological section).

Fig. 14. *Leiurus savanicola* male holotype. Habitus, dorsal aspect.

Distribution of the genus *Leiurus* in Africa

As already listed in previous publications (Lourenço, 2020b; Lourenço & El-Hennawy, 2021), following the discoveries and descriptions of new *Leiurus* species in Africa, the genus can now be confirmed for the following countries: Algeria, Cameroon, Chad, Egypt, Libya, Mali, Mauritania, Niger, Somalia, Somaliland, Sudan, and now for the first time in Nigeria. Occurrences for some other countries require yet a precise confirmation as for Ethiopia and Tunisia. The major population in Africa clearly corresponds to *Leiurus quinquestriatus* in Egypt and Sudan while the other species apparently are located in more patchy distributions (Fig. 15 map). The description of the new species from Nigeria seems to confirm this patchy model since the new species is apparently endemic to a very particular ecological habitat, out of the arid and desert zones where most species are present.

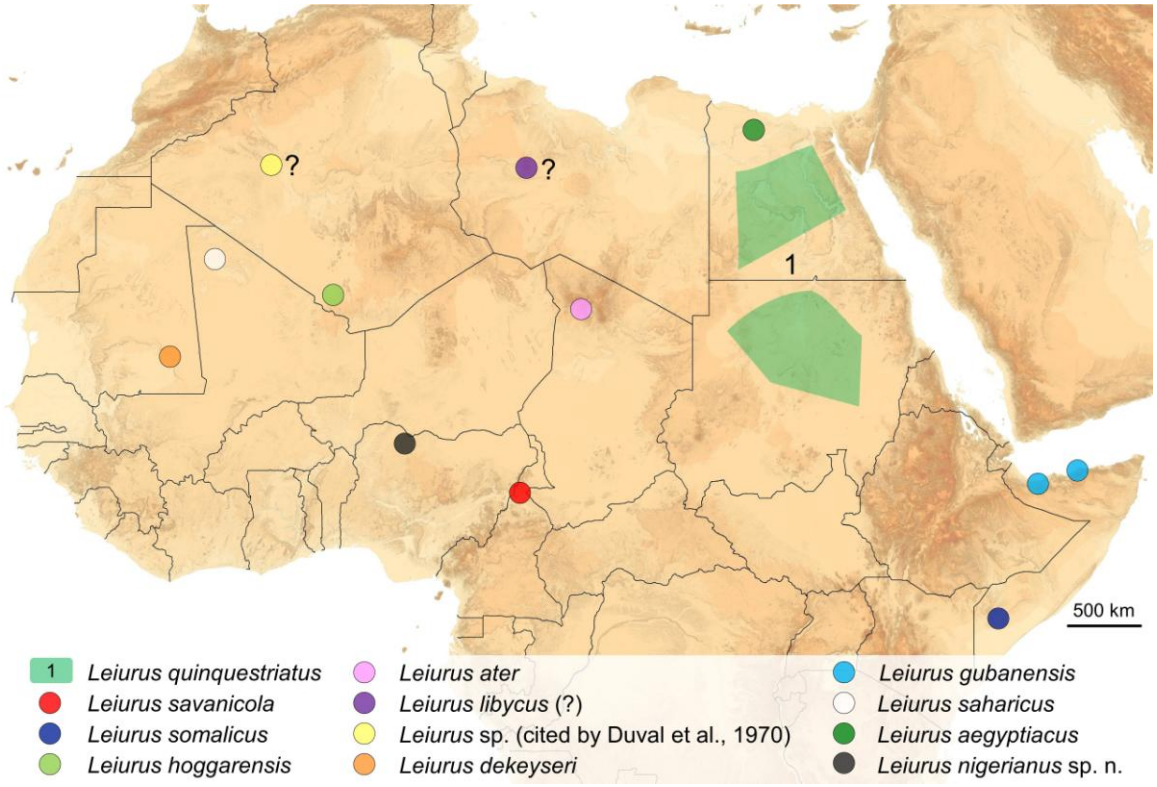


Fig. 15. Map of the North portion of Africa showing the distribution of the known *Leiurus* species.

Ecological comments

The typical vegetation formation in which the new scorpion was found is the West Sudanian savannah which corresponds to a tropical savannah ecoregion that extends across West Africa as a belt between humid forests in the South and arid zones and deserts in the North (see figure 1 in Dalibard *et al.*, 2014). The ecoregion stretches east and west across West Africa from the Atlantic coast of Senegal to the Mandara Mountains on Nigeria's eastern border. The much drier Sahelian Acacia savannah is located to the North while the humid Guinean forest-savannah mosaic extends in the South.

The weather conditions are dominated by a typical tropical climate. Annual rainfall ranges from 1000 mm in the South to 600 mm in the North on the edge of the Sahel. Rainfall and temperature vary seasonally, with a hot rainy season from May to September, and a cooler dry season from October to April. Temperatures range from 30°C to 33°C during the hottest month and from 18°C to 21°C during the coldest month.

The characteristic vegetation formations are Savannah and open woodland (Fig. 16). Common savannah tree species belong to genera *Combretum* and *Terminalia* while the soil is covered with long grasses, herbs, and shrubs. Species of *Hyparrhenia*, or elephant grass, is the predominant grass, and often grows up to one metre or more in height. Trees in the drier woodlands are generally not high and never reach up to 10 metres. These include in particular species of *Anogeissus*, but equally of *Acacia*, *Combretum*, *Commiphora*, *Prosopis*, *Tamarindus*, and *Ziziphus*.

In all cases the global diversity is much less important than that observed in the neighbouring forest (Ekwealor *et al.*, 2020; Muoghalu & Isichei, 1991). Since 2017. approximately 14% of this ecoregion was assessed as a protected area.

Fig. 16. The typical vegetation of Sudanian Savannas in Nigeria (photo modified from https://www.legit.ng/1096264-vegetation-zones-nigeria-features.html).

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I am most grateful to Elise-Anne Leguin (MNHN) for preparing the photos of the habitus of the new species and that of *Leiurus savanicola*.

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First record of the genus *Trypanothacus* Lowe, Kovařík, Stockmann & Šťáhlavský, 2019 in Jordan and description of a new species (Scorpiones: Buthidae)

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Abstract

The genus *Trypanothacus* Lowe, Kovařík, Stockmann & Šťáhlavský, 2019 (Family Buthidae) is recorded for the first time in Jordan and a new species is described based on specimens collected in the region of Al Azraq.

Keywords: Scorpion, *Trypanothacus*, new species, Al Azraq region, Jordan.

Introduction

The scorpion fauna of Jordan has been extensively explored and studied recently (Lourenço *et al*., 2021a, b; Abu Afifeh *et al.*, in publication), meanwhile eastern and southern deserts are still poorly studied and sampled. The psammophilous scorpions adapted to live in sandy deserts (Fet *et al*., 1998) are generally hard to collect or sample by the traditional diurnal rock flip method, so the records before using ultraviolet (UV)

detection of the scorpion from these deserts were limited and scattered. Recent surveys targeting these deserts using more efficient methods revealed a great diversity of scorpions; a number of works are in preparation to describe the scorpion fauna of eastern and southern Jordanian deserts.

The genus *Trypanothacus* Lowe, Kovařík, Stockmann & Šťáhlavský, 2019 was recently created based on species from Arabian Peninsula, by transferring *Buthacus buettikeri* originally described from Saudi Arabia to the new genus as *Trypanothacus buettikeri* (Hendrixson, 2006) and the description of *Trypanothacus barnesi* Lowe, Kovařík, Stockmann & Šťáhlavský, 2019 (Lowe *et al.*, 2019). This genus is very closely associated with the genus *Buthacus* Birula, 1908. The only apparent morphological difference provided to establish the new genus is the shape of telson, so the taxonomic position of this genus require yet further studies to be confirmed as valid; however, it is not the aim of the present note to discuss this point. This should be done in face of more relevant evidence. Fig. (1) shows the distribution of species belonging to the genus *Trypanothacus*.

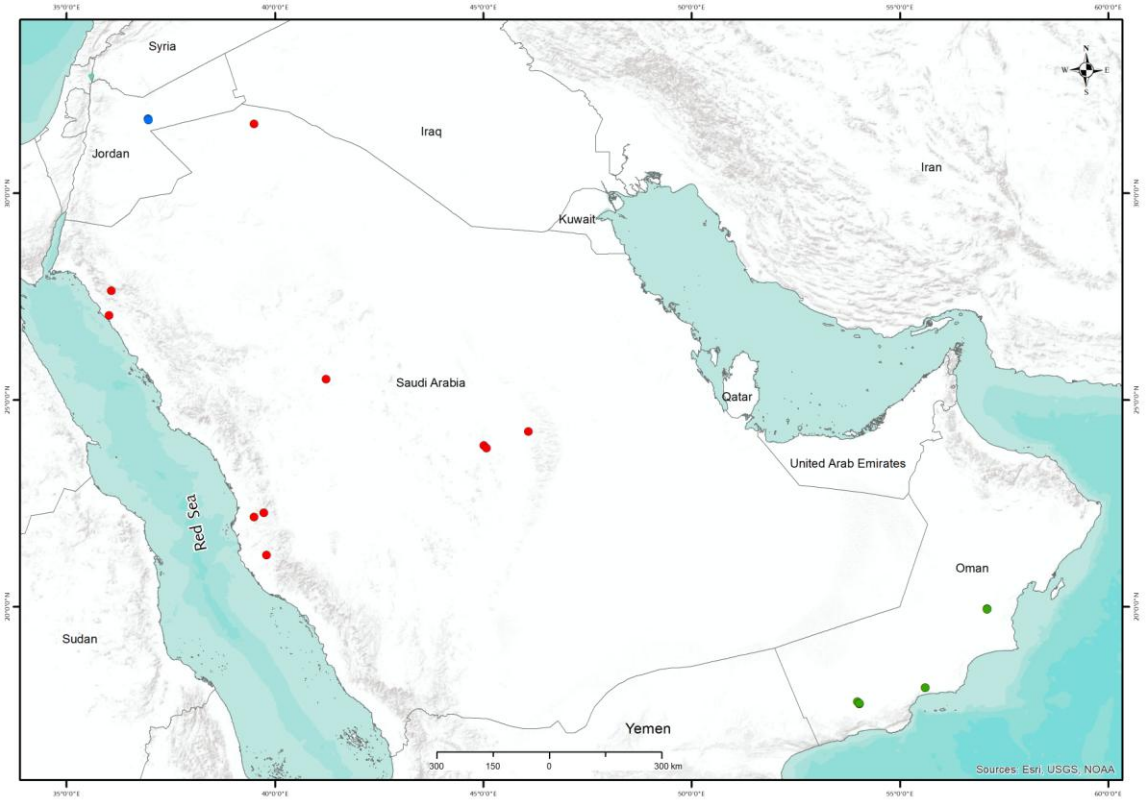

Fig. 1. Distribution of species of the genus *Trypanothacus.* Green circles: *Trypanothacus barnesi.* Red circles: *Trypanothacus buettikeri.* Blue circles: *Trypanothacus azraqensis.* Localities for Saudi Arabia and Oman area based on Hendrixson (2006) and Lowe *et al*. (2019).

Recently some specimens of buthid scorpions closely associated to the species *Buthacus buettikeri* Hendrixson, 2006, described from Saudi Arabia, were collected in Jordan. Since the species *B. buettikeri* was moved to the genus *Trypanothacus*, we decide to treat this material as belonging to this last genus. Consequently, this discovery represents the first record of the genus *Trypanothacus* and a new species is described at present based on new material collected in the north-eastern deserts of Jordan, in a region located SE of Al Azraq.

Material and Methods

Illustrations and measurements were made with the aid of a Wild M5 stereo-microscope with a drawing tube (camera lucida) and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations are those of Vachon (1974) and morphological terminology mostly follows Vachon (1952) and Hjelle (1990). The specimens studied herein will be deposited in the collections of the University of Jordan, Amman, Jordan and that of the Muséum national d'Histoire naturelle (MNHN), Paris.

One male and one female *T. buettikeri* collected from Ain Al Akhdhar (27°38'20.76"N, 36°49'19.61"E), Saudi Arabia, collected on 5 July 2021 by Abdulhadi Aloufi, now deposited in MNHN, Paris, are used as comparative specimens.

Taxonomic treatment

Family Buthidae C.L. Koch, 1837

Genus *Trypanothacus* Lowe, Kovařík, Stockmann & Šťáhlavský, 2019

Trypanothacus azraqensis sp. n. (Figs. 2-6)

Fig. 2. Habitus of alive *Trypanothacus azraqensis* sp. n. A. Male holotype. B. Female paratype.

Type material: Jordan: Holotype, 1 adult male, north-eastern desert of Jordan, 14 km SE of Al Azraq (31°47'43.5"N, 36°57'15.1"E), 522 m a.s.l., 2/IX/2021 (B. Abu Afifeh leg.). Paratypes: 1 adult male, one adult and one pre-adult females, 16 km SE of Al Azraq (31°46'00.1"N, 36°57'33.8"E), 527 m a.s.l., 30/IX/2021, (B. Abu Afifeh leg.).

Male holotype and one female paratype are deposited in the collections of the Muséum national d'Histoire naturelle, Paris (MNHN). One male and one female paratypes are deposited in the collections of the University of Jordan, Amman, Jordan.

Etymology: The specific name refers to the Azraq region, the locality from which the specimens were collected.

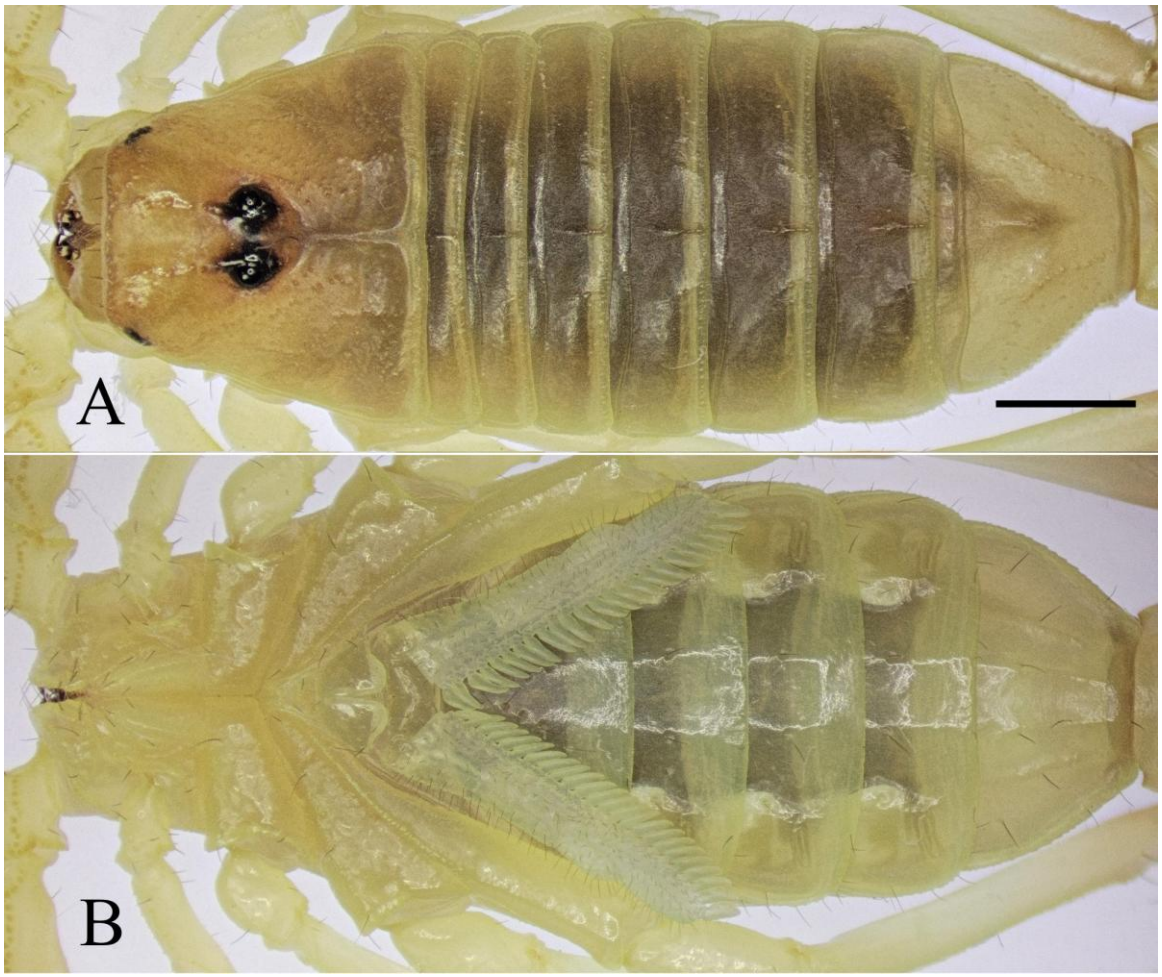

Fig. 3. *Trypanothacus azraqensis* sp. n. male holotype. A. dorsal aspect. B. ventral aspect. (Scale bar: 2 mm)

Diagnosis: Scorpions of moderate to small size with total lengths of 39-43 mm for males and 40-49 mm for females. General colouration yellow to pale yellow, without marked spots in adults; anterior region of carapace marked by an inverted pale reddish-yellow triangle in both sexes; female tergites marked by confluent pale olivaceous spots. Pedipalps with 8-9 and 9-9 rows of granules on the fixed and movable fingers of males and females; internal and external accessory granules present and well marked. Large granules dividing rows are moderate to strong. Trichobothriotaxy A-β (beta); trichobothrium **Esb** on chela-hand slightly proximal in relation to **Est**; trichobothrium $\mathbf{e_1}$ of femur almost at the same level of trichobothrium $\mathbf{d_3}$. Ventral carinae on metasomal

segments II and III with well-marked spiniform granules, more conspicuous in females; latero-ventral carinae on segment V with spinoid granules and some well-marked lobes. Tibial spurs moderate to strong on legs III and IV. Pectinal tooth count 24 to 25 in males and 18 to 20 in females. Tarsi typical of a psammophilous species.

Description based on male holotype and paratypes (Table 1). Colouration: Generally yellow to pale yellow without any marked spots or pigmented zones on the body and appendages; the anterior region of the carapace is slightly marked by an inverted reddish-yellow triangle; pre-adult female tergites also equally marked by some confluent olivaceous pigmentation. Prosoma: carapace basically yellow; eyes surrounded by black pigment. Mesosoma: yellow, with tergites slightly olivaceous in females. Metasomal segments yellow. Vesicle yellow; aculeus yellow at the base and reddish at its extremity. Venter yellow; pectines pale yellow. Chelicerae yellow; denticles dark red to almost blackish. Pedipalps: yellow overall; rows of granules on the dentate margins of the fingers reddish. Legs yellow, paler than body.

Table 1. Morphometric values (in mm) of the male holotype & female paratype of *Trypanothacus azraqensis* sp. n. and a male of *Trypanothacus buettikeri* from Saudi Arabia.

Morphometric values (in mm)	***Trypanothacus azraqensis* sp. n.**		***T. buettikeri***
	Male holotype	Female paratype	Male
Total length	42.7	49	47.8
Carapace			
- Length/ anterior width/ posterior width	4.8/3.3/5.6	5.5/3.4/6.7	5.2/3.5/6.2
Mesosoma length	10.2	12.7	12.2
Metasomal segment I			
- Length/ width	3.5/3.4	4.1 /3.6	3.9/3.6
Metasomal segment II			
- Length/ width	4.3/3.2	4.5/3.3	4.6/3.5
Metasomal segment III			
- Length/ width	4.5/3.0	4.55/3.3	4.8/3.4
Metasomal segment IV			
- Length/ width	5.1/2.8	5.10 / 3.00	5.5/3.2
Metasomal segment V			
- Length/ width/ depth	5.8/2.5/2.2	6.0/2.8/2.3	6.3/2.6/2.3
Telson length	4.5	5.3	5.3
Vesicle			
- Width/ depth	2.2/2.1	2.4/2.2	2.1/2.1
Pedipalp			
- Femur: Length/ width	3.9/1.5	3.9/1.6	4.3/1.6
- Patella: Length/ width	4.5/2.0	4.6/1.95	4.8/2.2
- Chela: Length/ width/ depth	7.2/2.2/2.2	7.25/1.6/1.8	7.7/2.2/2.3
Movable finger			
- Length	4.1	4.4	4.4

Morphology. Anterior margin of carapace (Fig. 4C) almost straight with a minute convexity. Carapace carinae weakly developed; anterior median carinae obsolete; central median, posterior median, and central lateral carinae weak to obsolete. All furrows weak

to obsolete. Intercarinal spaces weakly granular. Median ocular tubercle slightly anterior to the centre of the carapace; median eyes separated by almost two ocular diameters. Five pairs of lateral eyes; four disposed in one line, the fifth situated behind eye four; fourth and fifth vestigial. Mesosoma: Tergites (Fig. 3A) I to VI tricarinate; all carinae very weak; lateral carinae vestigial on segments I and II; tergite VII pentacarinate, with lateral pairs of carinae moderate; median carinae present on almost all the length of the tergite; weakly to moderately marked. Intercarinal spaces weakly granular to smooth. Sternites (Fig. 3B): Carinae absent from sternites III-VI; weak on VII. Pectines moderately large; pectinal tooth count 24 to 25 in males and 18 to 20 in females (see diagnosis for variation). Metasoma (Fig. 5): Metasomal segments I to III with 10 carinae; IV with 8 carinae; intermediate carina largely incomplete on II and III. Ventral carinae moderate on segment I; moderate to strong on II to IV; segments II and III with some large spinoid granules better marked on females; dorsal carinae without any well marked spinoid granules on segments I to IV. Segment V with five carinae; ventrolateral armed with spinoid granules and several conspicuous lobes, better marked on females. Dorsal furrows in all segments weakly developed, smooth; intercarinal spaces not granular, smooth. Metasomal setation moderate to weak. Telson granular better marked on female.

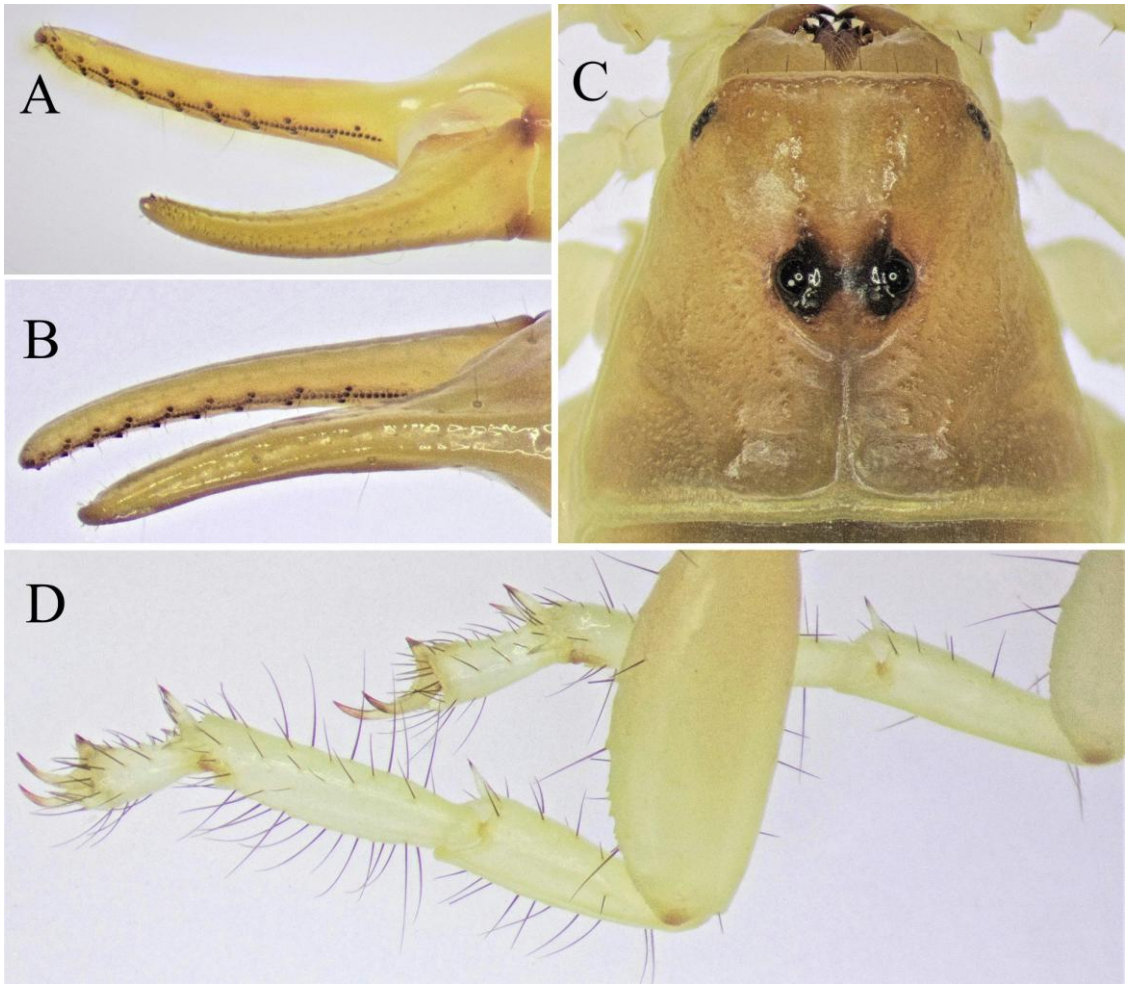

Fig. 4. *Trypanothacus azraqensis* sp. n. male holotype. A. Fixed finger of pedipalp. B. Movable finger of pedipalp. C. Prosoma. D. Right legs III and IV, prolateral aspect.

Aculeus shorter than vesicle and strongly curved; subaculear tubercle absent. Chelicerae movable finger with external distal denticle similar in length to internal distal; two well

marked denticles at the base of the movable finger (Vachon, 1963). Pedipalps: trichobothrial pattern A-β (beta) orthobothriotaxic, as defined by Vachon (1974, 1975); trichobothrium **Esb** on chela-hand slightly proximal in relation to **Est (**Fig. 6A); trichobothrium $\mathbf{e_1}$ of femur almost at the same level of trichobothrium $\mathbf{d_3}$ (Fig. 6D). Femur pentacarinate; all carinae strongly crenulate. Patella with well marked internal carinae; chela without carinae, smooth. Dentate margins on fixed and movable fingers (Figs. 4A-B) composed of 8-8 and 9-9 almost linear rows of granules; internal and external accessory granules represented by strong basal granules; external and internal accessory granules well marked; the dentate margins granulation is not masked by setation. Legs (Fig. 4D): ventral aspect of tarsi with numerous long thin setae; general setation typical of a psammophilous species (Fet *et al.*, 1998). Tibial spurs strong on legs III-IV. Pedal spurs strong on all legs.

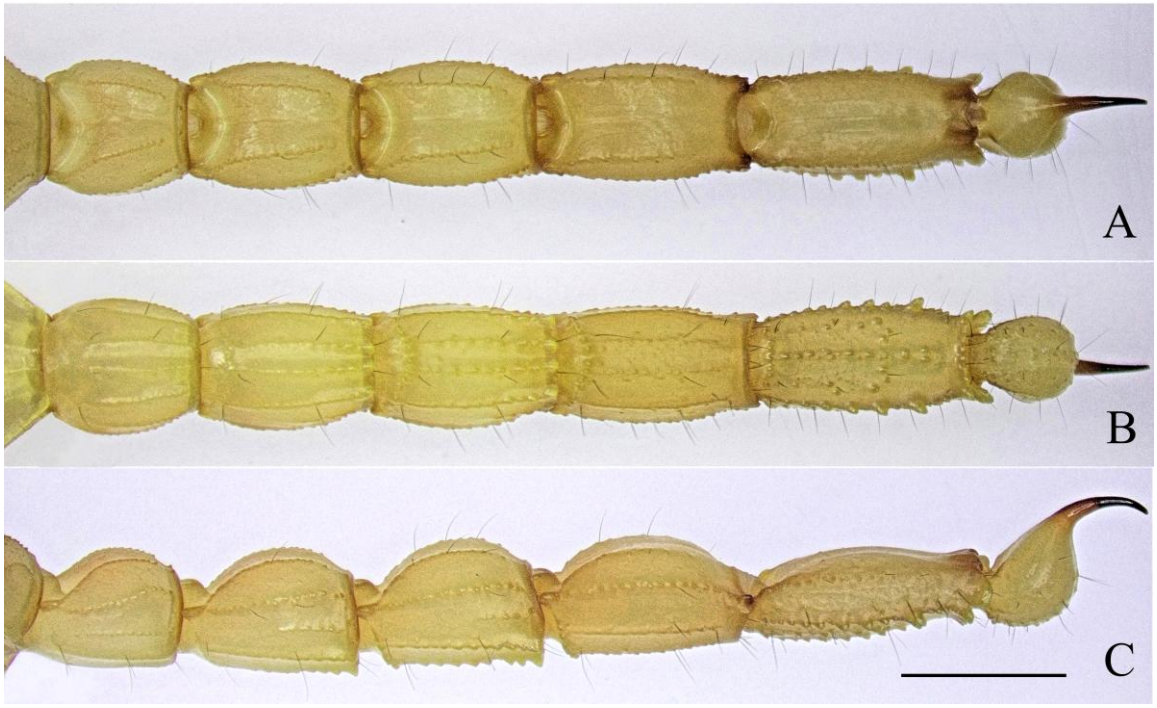

Fig. 5. Metasoma and telson of *Trypanothacus azraqansis* sp. n., male holotype. A. dorsal aspect. B. ventral aspect. C. lateral aspect. (Scale bar: 4 mm)

Relationships. In account of its zone of distribution and the presence of some common characters the new species seems to be closely related to *Trypanothacus buettikeri* (Hendrixson, 2006) species described from Saudi Arabia. The new species can, however, be distinguished from other by two features: (i) different morphometric values and ratios; females metasomal segments is more slender in *Trypanothacus azraqensis* sp. n.; average of length to width ratios of segments I (1.10); II (1.36); III (1.41); V (2.16) in females of *Trypanothacus azraqensis* sp. n., the females of *T. buettikeri* and *T. barnesi* are less slender , more robust in metasomal segments , the length to width ratios of segments I: (1.01, 1.02); II (1.25, 1.22); III (1.33, 1.30); V (1.84, 2.09) respectively (Table 2) (ii) some differences in the trichobothrial pattern; in the new species trichobothrium **Esb** on chela-hand is slightly proximal in relation to **Est**, while trichobothrium $\mathbf{e_1}$ of femur is almost at the same level of trichobothrium $\mathbf{d_3}$; contrarily in *T. buettikeri* trichobothrium **Esb** is distal in relation to **Est** and trichobothrium $\mathbf{e_1}$ is almost at the same level of $\mathbf{d_4}$ (Figs. 6-7).

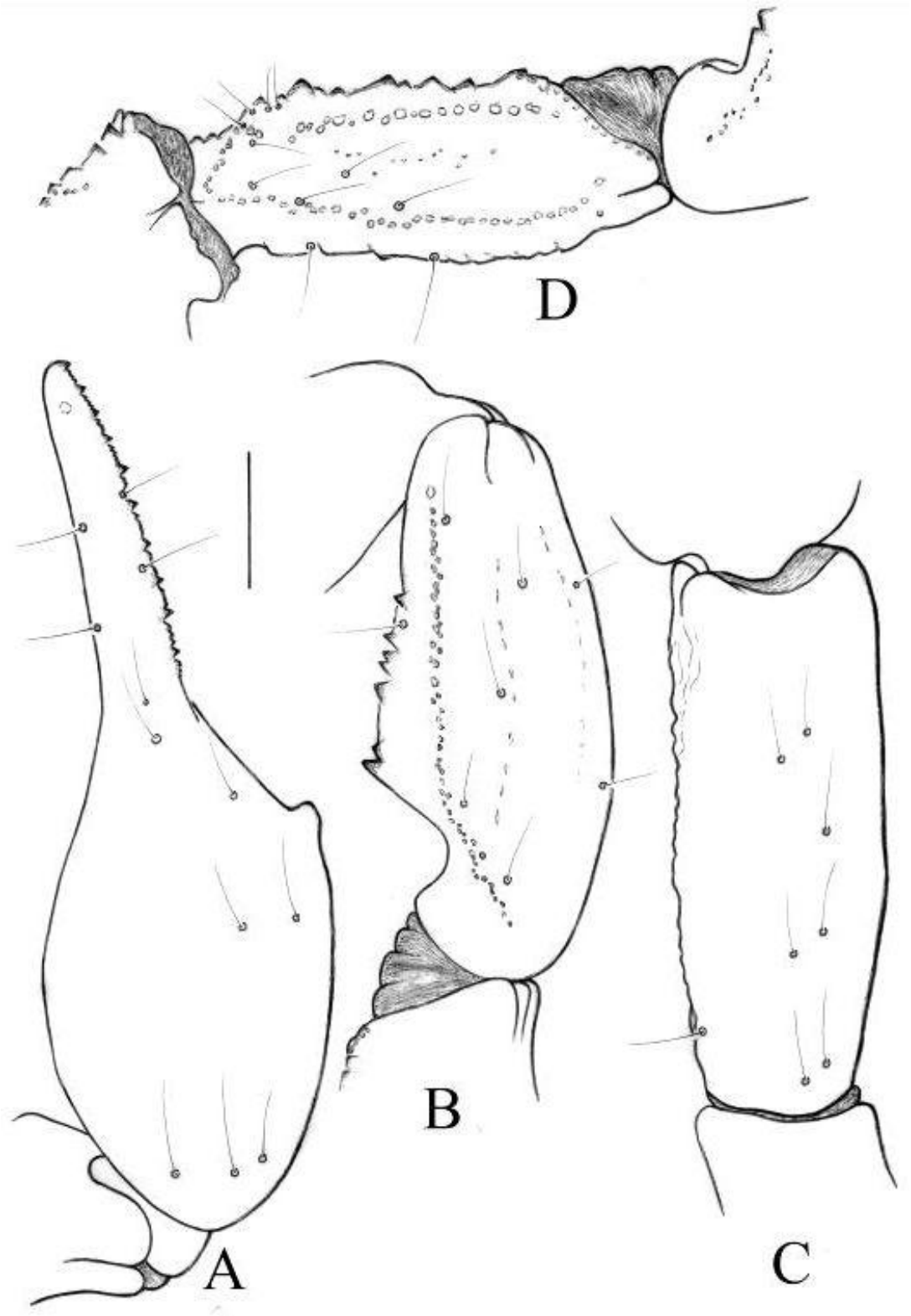

Fig. 6. *Trypanothacus azraqensis* sp. n. Male holotype. Trichobothrial pattern. A. Chela, dorso-external aspect. B-C. Patella, dorsal and external aspects. D. Femur, dorsal aspect. (Scale bar: 1 mm)

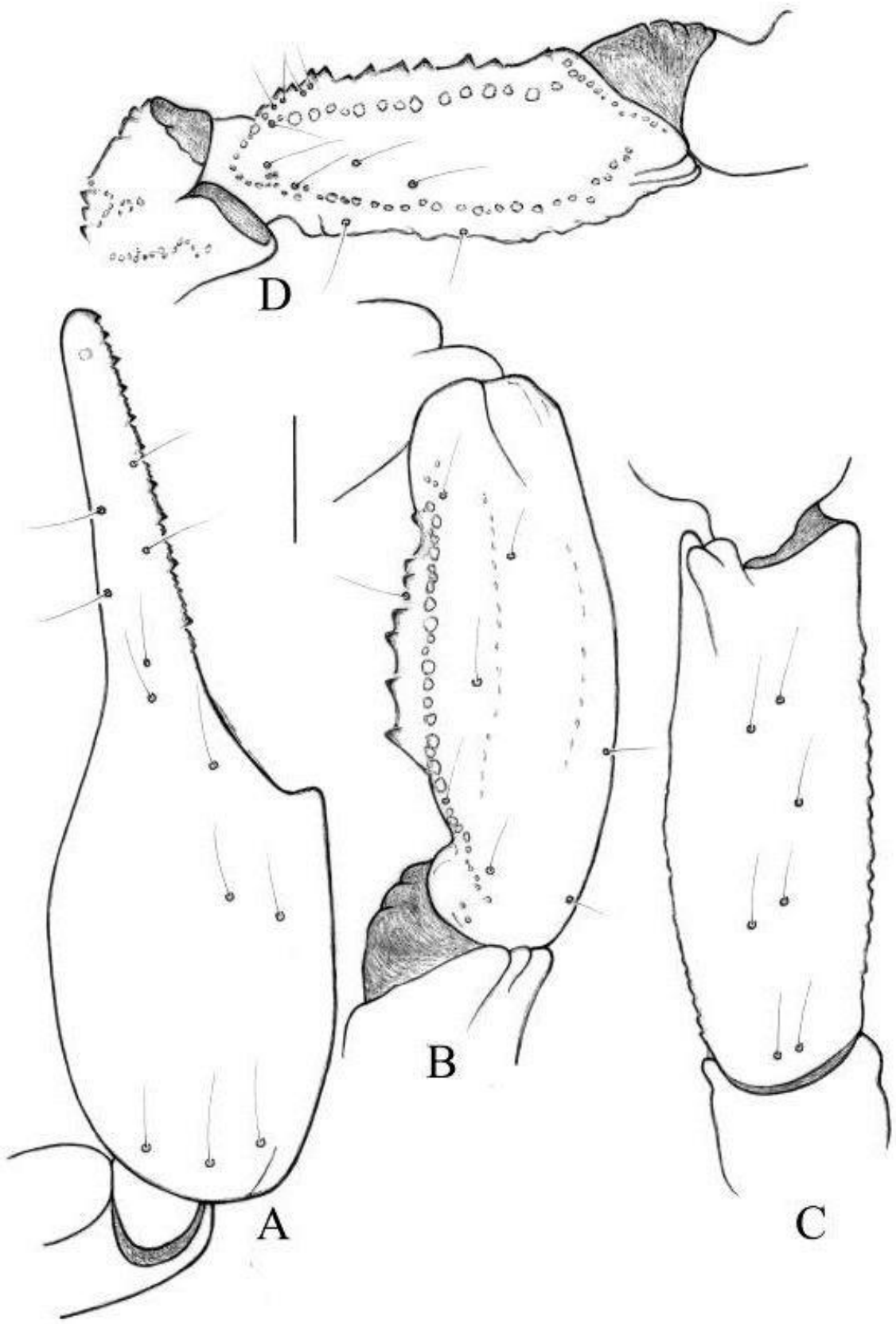

Fig. 7. *Trypanothacus buettikeri*, male from Saudi Arabia. Trichobothrial pattern. A. Chela, dorso-external aspect. B-C. Patella, dorsal and external aspects. D. Femur, dorsal aspect. (Scale bar: 1 mm)

Table 2. Morphometric measurements of length/width ratios of females for three species of the genus *Trypanothacus*.

Morphometric values (in mm)	***T. azraqensis*** sp. n.		♀ paratype ***T. buettikeri*** Saudi Arabia (Hendrixson, 2006)	♀ paratype ***T. barnesi*** Oman (Lowe *et al.*, 2019)
	♀ paratype 1	♀ paratype 2		
Total length (Including telson)	49.0	40.0	55.9	56.78
Metasomal segment I				
Length / width	4.1/3.6	3.2/3.0	4.35/4.3	3.76/3.7
Length / width ratio	1.14	1.07	1.01	1.02
Metasomal segment II				
Length / width	4.5/3.3	3.80/2.8	5.0/4.0	4.21/3.45
Length / width ratio	1.36	1.36	1.25	1.22
Metasomal segment III				
Length / width	4.55/3.3	4.0/2.8	5.2/3.9	4.34/3.33
Length / width ratio	1.38	1.43	1.33	1.3
Metasomal segment IV				
Length / width	5.1/3.0	4.20/2.6	6.1/3.5	5.34/3.14
Length / width ratio	1.7	1.62	1.74	1.7
Metasomal segment V				
Length / width / depth	6.0/2.8/2.3	5.2/2.4/2.1	6.80/3.70/2.85	6.1/2.92/2.39
Length / width ratio	2.14	2.17	1.84	2.09

Fig. 8. Habitat of Azraq area from which the holotype was collected.

Ecological comments on the type locality

Azraq area represents an oasis in the Jordanian eastern desert. It is located within the Saharo-Arabian region, the largest biogeographical ecozone. The soil is mostly gravel, sandy Hamada, saline and sandy. Altitude ranges from 100 m - 800 m asl, with annual rainfall not exceeding 50 mm. The collecting site is located very close to Wadi Rajil, whereas the soil is mainly gravelly interrupted with wind-blown sand sheets. Dominant vegetation consists of *Anabasis* sp. and *Tamarix aphylla* (Fig. 8). Five species of

scorpions were collected from the site; *Androctonus crassicauda* (Olivier, 1807), *Compsobuthus jordanensis* Levy, Amitai & Shulov, 1973, *Buthacus* sp., *Orthochirus* sp., and *Scorpio* sp.

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Report of camel spiders (Solifugae: Galeodidae) predation by Saharan horned viper *Cerastes cerastes* (Linnaeus, 1758) in Northern Algerian Sahara

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Abstract

This note reports an important case of predation on camel spiders (Solifugae: Galeodidae) by Saharan horned viper *Cerastes cerastes* (Linnaeus, 1758) (Squamata, Viperidae), based on the presence of Solifugae fragments in the faeces of these snakes sampled from Northern Algerian Sahara. This snake is ranked as opportunistic predator with varied diets consists mainly of lizards, small rodents, and birds. Solifugae are recorded for the first time as Saharan horned viper prey.

Keywords: Solifugae, horned viper, predation, Algeria.

Introduction

The diet of Saharan horned vipers is remaining unknown (Al-Sadoon & Paray, 2016). Although some snakes are specialists with narrow diets, many exhibit a substantial variation in diet at both individual and population levels (Greene, 1997). This viper is

generally recognized as opportunistic predators with varied diets (Al-Sadoon & Paray, 2016). Analysis of the stomach content of the *Cerastes c. gasperettii* Leviton & Anderson, 1967 showed that the preferred food is primarily rodents, arthropods and lizards (Campbell & Lamar, 2004; Al-Sadoon & Paray, 2016), while small rodents, lizards, and small birds are considered as the main food for *Cerastes gasperettii* (Gasperetti, 1988). The arthropod matter (beetles essentially) compose 15% of the total prey found in the gut content of *Cerastes c. gasperettii* (Al-Sadoon & Paray, 2016) and about 12.5 % of the content in *Eryx jayakari* Boulenger, 1888 (Al-Sadoon & Al-Otaibi, 2014).

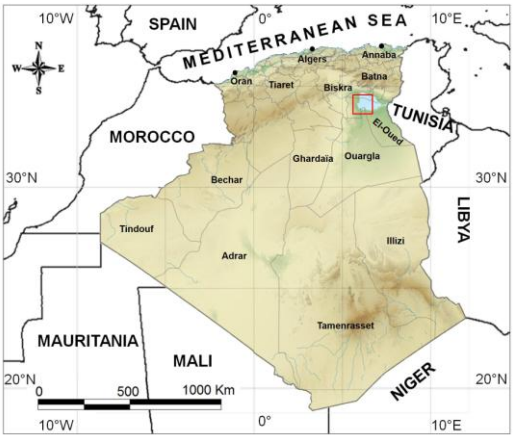
In this note, we report cases of predation on camel spiders (Solifugae, Galeodidae) by Saharan horned vipers, *Cerastes cerastes* (Linnaeus, 1758), from Northern Algerian Sahara, based on observations of Solifugae fragments in their faeces collected in laboratory conditions (snakes kept deprived of food).

Material and Methods

Study in field

This field work was carried out in the region of Oued Righ (Eastern Algerian) (Fig. 1A). This region is Sebkha type (wetland), situated at an average altitude of 6 m, with a total area 337,700 ha (RAMSAR, 2001). Characterised by homogeneity of the plant cover and dominance of halophytes herbaceous plants such as *Salicornia europaea* (Amaranthaceae), *Tamarix gallica* (Tamaricaceae), *Phragmites communis* (Poaceae), *Juncus acutus* (Juncaceae), and *Carex* sp. (Cyperaceae).

Because this viper is a nocturnal or/and crepuscular true desert snake and prefers sandy soil with some vegetation as shelters (Heatwole & Davison, 1976; Le Berre & Chevallier, 1989; Al-Sadoon & Paray, 2016), all our sampling trips were nocturnal by researching them between herbaceous or by tracking their traces (Fig. 1B).



A

B

Fig. 1. Field work: A. Map of Algeria, showing our study region (red square). B. Saharan horned viper trace in nocturnal sampling trip.

Study in Laboratory

Specimens of snakes (Fig. 2A-B) were kept in Laboratory of Zoology (University of Ghardaïa, Algeria) deprived of food for a long period (more than one month) in order to recover their faeces. Domergue (1960) noted that the duration of the digestive phenomena of horned viper requires a time of 5 to 22 days. Faecal samples can be taken

relatively easily from snakes by gently massaging the posterior part of the abdomen (Fitch, 1987), so this is a feasible way to identify food items in those animals (McDiarmid *et al.*, 2012). All faeces are collected and carefully analysed using a stereo-microscope after soaking in ethanol (70%).

A  B

Fig. 2. Saharan horned viper. A. an individual recently found. B. lateral view of the *Cerastes cerastes* head.

Results and Discussion

Through the study of 10 samples of *Cerastes cerastes* were kept fasting in Laboratory more than a month. We have collected 20 of faecal balls whose size is between 3-5 cm (Fig. 3A). Domergue (1960) reported that the faecal balls of *C. cerastes* can reach the size of a pellet rejected by big birds like owls (Strigiformes). Because, the fragments of Solifuge were observed in 10 of faecal balls (50%), it is qualified as constant species in diet of this snake.

A  B

Fig. 3. Faecal matter analysis. A. faecal ball of Saharan horned viper. B. extracted fragments (Chelicerae) of *Galeodes* sp.

The present paper is interested in identifying the fragments of Solifugae found in faecal matter of Saharan horned viper. The results showed the presence of Solifugae fragments essentially composed of chelicerae. Basing on cheliceral teeth (Fig. 3B), the Solifugae prey can be identified as *Galeodes* sp., Family Galeodidae (Bird *et al.*, 2015).

Despite, these arachnids are poorly studied in the world (Harvey, 2002) and the same in Algeria (Sadine & El Bouhissi, 2019). The genus *Galeodes* was cited as a widely distributed species in Algeria (El-Hennawy, 1999; Harvey, 2013).

The Saharan horned viper is ranked as opportunistic predator (Al-Sadoon & Paray, 2016) with varied diets consists mainly of lizards, small rodents, and birds (Domergue, 1960; Campbell & Lamar, 2004; Al-Sadoon & Paray, 2016). Solifugae are recorded for the first time as Saharan horned viper prey and as a constant species in this case.

We note also that, the breeding activity of horned viper near Saharan wetlands requires a maximum of energy, mainly from a varied and protein-rich diet. This is also highly dependent on nocturnally active prey, including Solifugae, because the animal matter (terrestrial arthropods) is energetically rewarding (Herrero *et al.*, 2006).

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Notes on a case of fungal pathogenesis on a juvenile of the theraphosid spider *Aphonopelma gabeli* Smith, 1995 in captivity (Araneae: Theraphosidae)

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Abstract

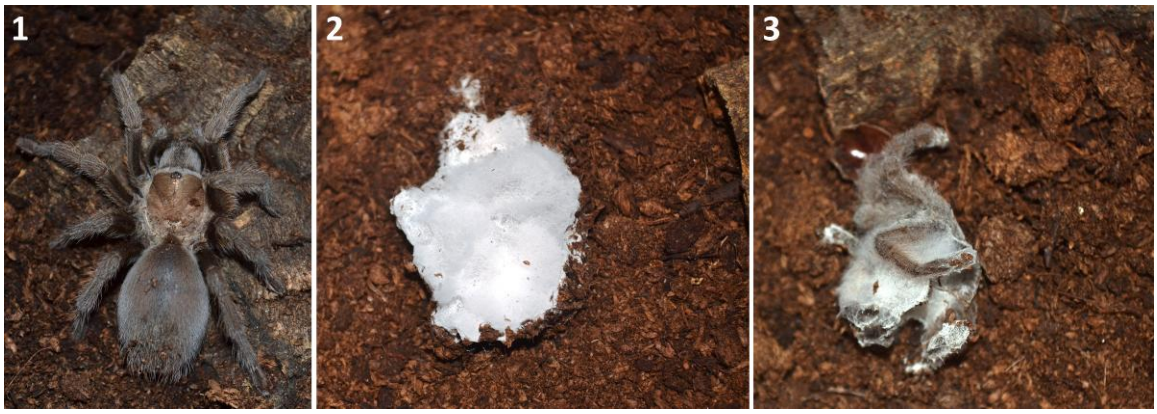
A case of fungal pathogenesis in a captive-bred specimen of the North American theraphosine *Aphonopelma gabeli* Smith, 1995 is reported and illustrated.

Keywords: fungus, Cordycipitaceae, spider, Theraphosidae, *Lecanicillium*, *Engyodontium*.

Fungal pathogenesis of spiders has been reported for at least two centuries in varying degrees (Evans & Samson, 1987; Evans, 2013). Much taxonomic work has focused on taxa in the family Cordycipitaceae Kreisel ex G. H. Sung, J. M. Sung, Hywel-Jones & Spatafora, 2007 most intensively on species of the nominal type genus *Cordyceps* Fries, 1818 which is a well known pathogen of theraphosid spiders (e.g. Marchionatto, 1945; Mains, 1954; Barbosa *et al*., 2016; Ávila Guerrero, 2019). Another genus, *Torrubiella* Boudier, 1885 has also been documented as a theraphosid pathogen (e.g. Loayza *et al*., 2014) and other genera have been reported as pathogens of a wider range of spider taxa (see Evans, 2013).

The theraphosid spider *Aphonopelma gabeli* Smith, 1995 is distributed across Arizona, New Mexico and Texas in the United States of America (Hamilton *et al.*, 2016) and also likely occurs in northernmost Mexico (Sherwood, 2019; Sherwood & Gabriel, 2020; Heckard & Sherwood, 2021). This species has been legally exported from the United States and subsequently traded in the pet hobby for a number of years. A captive bred juvenile of *A. gabeli*, originating from a successful breeding of specimens initially exported from the USA, was gifted to the author in January 2013 by a hobbyist, and appeared in good health. The spider was housed on heat-sterilised coir substrate with a small piece of cork bark (also heat-sterilised) for décor with stable temperature variables

(daytime and night-time temperatures approximately 25°C and 21°C respectively). After a few weeks, the specimen developed a shiny black colouration to the cuticle of the opisthosoma which indicated that it was imminently pre-ecdysis (Fig. 1).



Figs. 1-3. *Aphonopelma gabeli* Smith, 1995 juvenile. 1. habitus pre-ecdysis. 2. freshly moulted specimen deceased and covered in white fungus. 3. freshly discarded exuvia covered in white fungus.

On 18/03/2013 the specimen was observed supine, about to attempt ecdysis. The next morning, it was discovered that the spider was dead and that the entirety of the freshly moulted specimen was covered in white fungus, in addition to the exuvia itself, which was discarded approximately 10cm from the specimen (Figs. 2-3). No fungus was found elsewhere in the enclosure, the substrate or on the piece of cork bark.

Despite a sample of the fungus being preserved (by freezing) at the time of discovery, this sample gradually deteriorated over a number of years. Unfortunately, this precludes a precise generic or species level identification of the fungus growth which affected the spider.

Nonetheless, the photographic evidence (Figs. 2-3) suggests that the fungus is of the family Cordycipitaceae and the opinion of a specialist mycologist from the Centre for Agriculture and Bioscience International (CABI) is that it may belong within a complex containing the genera *Lecanicillium* Gams & Zare, 2001 and *Engyodontium* de Hoog, 1978 (Harry Evans pers. comm.). The nature of the fungus was as a chitin degrader, likely transmitted from a previous source of substrate. This also explains why both the freshly moulted spider and the discarded exuvia are both covered in spores. Interestingly, the photographs demonstrate only one fungus covering the specimen (Harry Evans pers. comm.), which appears to be unusual compared to spiders which have died of natural causes (the latter usually hosting a number of species of non-pathogenic fungi). It is possible that the pathogenesis could have been accelerated if the spider was cryptically immunocompromised (Benjamin Kennedy pers. comm.) but this cannot be said with any degree of certainty at present.

Veterinary interest in captive spiders started in earnest with works such as Cooper (1987) and the literature has steadily grown for theraphosid spiders in particular since the end of the twentieth century (e.g. Pizzi *et al*., 2001; Melidone, 2007; Pellett *et al*., 2015; Lambert, 2017; Draper & Trim, 2018; Wyrobisz-Papiewska *et al*., 2019). However, many gaps still exist in knowledge and it is important that unusual cases, such as that presented here, are reported in order to further current understanding at a basic level, promote development of new treatments and management techniques, and in turn, encourage more detailed research by veterinary clinical researchers into these areas in the future.

Acknowledgments

I would like to thank Stacey Mackenzie for kindly gifting the juvenile spider, Harry Evans (Centre for Agriculture and Bioscience International) for identifying the fungus and Cristian Grismado (Museo Argentina de Ciencias Naturales "Bernardino Rivadavia") for providing difficult-to-obtain literature. Harry Evans (CABI) and Benjamin Kennedy (Veterinary Invertebrate Society) are thanked for invaluable comments on an early draft of the manuscript.

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Pterotricha esyunini Zamani, 2018 (Araneae: Gnaphosidae), a new record for Iraqi spiders

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Abstract

The spider specimens in the present study were collected from desert habitat located northwest of Thi Qar Province, south of Iraq. A new record has been made for *Pterotricha esyunini* Zamani, 2018 which has only been described from the United Arab Emirates (UAE). Illustrations of the species and a map of the specimen collecting location are provided.

Keywords: Araneae, Gnaphosidae, *Pterotricha esyunini*, new record, Thi Qar, Iraq.

Introduction

Studies on Iraqi spiders are few compared to some neighbouring countries. But recently, a number of research papers on spiders have been published in different Provinces of this country (Ahmed & Ahmed, 2012; Al-Hadlag & Najim, 2015; Zamani & El-Hennawy, 2016; Seyyar *et al*., 2016; Demir *et al*., 2017; Al-Khazali & Hussein, 2019; Al-Khazali, 2020; Al-Khazali & Fomichev, 2021). Fomichev *et al*. (2018) published new data on spider fauna in Iraq, in which they recorded only 33 species.

Family Gnaphosidae Banks, 1892 is among the richest families of species of spiders in the Middle East, and the genus *Pterotricha* Kulczyński, 1903 is abundant but it is little known in Europe, where *Gnaphosa* Latreille, 1804 is abundant in the northern hemisphere (Levy, 1995). Gnaphosidae currently includes 2583 species belonging to 163

genera and there are 44 species of *Pterotricha* (Jocqué & Dippenaar-Schoeman, 2006, World Spider Catalog, 2021).

This family is characterized by its large parallel and cylindrical anterior spinnerets, greatly enlarged piriform glands spigots that have a flattened base and shaft, and a slit-like opening (Jocqué & Dippenaar-Schoeman, 2006). *Pterotricha* spiders are medium-sized gnaphosinae, 5-13 mm in body length (Levy, 1995).

Material and Methods

Sampling was carried out from 1 to 28 February 2021 at the desert habitat, Thi Qar Province, south of Iraq (Fig. 1). Samples were surveyed from the habitat shown in Fig. (2). The specimens were preserved in 70% ethanol, and were photographed using a Nikon Z50 camera on a Krüss stereomicroscope, and then Digital images were prepared using image stacking software (Zerene stacker). Measurements are given for the segments of the legs (femur, patella, tibia, metatarsus, tarsus), and all measurements are in millimetres.

The map was created using an online web page **(**http://www.simplemappr.net/).

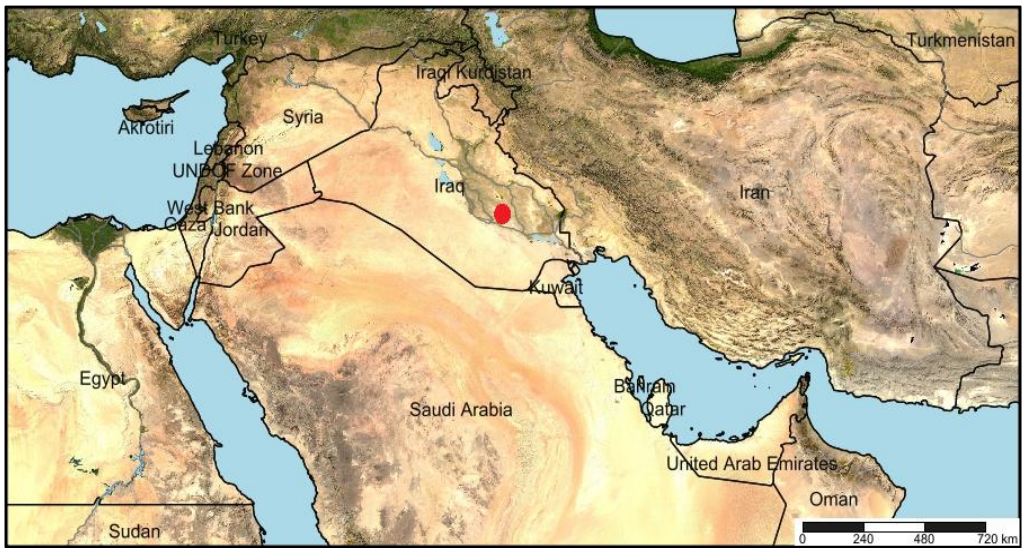

Fig. 1. Map of collecting location (red circle): Thi Qar Province, northwest of Al-Nasiriyah city, Al-Kata'a region.

Taxonomy

Family **Gnaphosidae** Banks, 1892
Genus ***Pterotricha*** Kulczyński, 1903

Pterotricha esyunini Zamani, 2018 (Figs. 3-4)
Pterotricha esyunini: Zamani, 2018: 153-155, figs. 1c, 2b, 3b (♂).

Material Examined. 5♂♂, Al-Kata'a region, Thi Qar Province, south of IRAQ, 31º18'47"N, 45º54'12"E, 9 m a.s.l, 1-28 February 2021.

Description of Male. Habitus, dorsally and ventrally as in Fig. (3). Total length 9.5. Carapace 4.9 long, 4.5 wide. Opisthosoma 4.6 long. Leg measurements: I: 18.1 (5.5, 1.5, 3.4, 4.5, 3.2), II: 18.1 (4.8, 1.9, 3.5, 4.9, 3.0), III: 19.5 (5.3, 1.5, 3.5, 5.9, 3.3), IV: 21.0 (6.0, 1.5, 4.5, 6.0, 3.0).

Fig. 2. Collecting location, Al-Kata'a region.

There are no distinct patterns on the body, most of the areas are light brown, including carapace, labium, sternum, maxillae as well as the legs with clear spines, while the colour of fangs is dark brown. Chelicerae with a triangular serrated keel retrolaterally. The eyes are arranged in two rows and posterior median eyes are oval.

Abdomen is darker in colour than carapace with clear setae. Tarsi of legs with pseudo-segmentations. Palp as in Fig. (4). Tibia with a long, needle-shaped spur (Macroseta) located on the dorsal side, apophysis of tibia in the retrolateral view of the male palp is of a distinctive shape, extending horizontally and pointing upwards with a tooth-like terminal end.

Female. Unknown.

Distribution. *Pterotricha esyunini* was previously known only from four regions in the United Arab Emirates, and it is recorded in the current study from southern Iraq.

Discussion

No species of the genus *Pterotricha* was previously recorded in Iraq except the species *Pterotricha arzhantsevi* Fomichev, Marusik & Koponen, 2018, which is endemic in Iraq (World Spider Catalog, 2021). In the current study, a second record of this genus is reported in Iraq by the first record of *P. esyunini*, which was previously known only in the United Arab Emirates by Zamani (2018). Females of this species are still unknown.

It is possible that future studies on *Pterotricha* may reveal the presence of other species of it because the environment of Iraq has many desert habitats, especially in southern Iraq, where the study on spiders is lacking, as Levy (1995) confirmed the presence of species of this genus in abundance in the Middle East and North Africa.

Acknowledgments

All thanks and great gratitude to Prof. Hisham K. El-Hennawy (Egypt) and Ali Zamani (Iran) for their assistance in confirming the identity of species, and we also thank Mr. Karar Raihan (Iraq) for his assistance in collecting samples from the field. Beautiful thanks to Mrs. Haneen Imad (Iraq) for helping us to deal with samples under the microscope.

Fig. 3. Habitus of *Pterotricha esyunini* Zamani, 2018 ♂. A. dorsal view. B. ventral view.

Fig. 4. Palp of *Pterotricha esyunini* Zamani, 2018 ♂. A. retrolateral view. B. ventral view.

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Prodidomus redikorzevi Spassky, 1940 (Araneae: Gnaphosidae: Prodidominae), the first record of the subfamily in Iraq

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Abstract

The female of *Prodidomus redikorzevi* Spassky, 1940 is redescribed based on newly collected material from Iraq. The genus *Prodidomus* Hentz, 1847 and the subfamily Prodidominae Platnick & Shadab, 1976 are recorded from Iraq for the first time. Digital photographs and a map of distribution records of *P. redikorzevi* are provided.

Keywords: Araneae, Gnaphosidae, Prodidominae, *Prodidomus redikorzevi*, Middle East, Iraq.

Introduction

Prodidominae is a subfamily of Gnaphosidae, represented by 33 genera with 316 species (Rodrigues & Rheims, 2020), among them 55 species belong to the genus *Prodidomus* Hentz, 1847 which has almost worldwide distribution, including ten known species from the Near East and Middle East region. The species *Prodidomus redikorzevi* Spassky, 1940 occurs in Azerbaijan, Kazakhstan, Turkmenistan and in two countries bordering Iraq, *i.e.*, Turkey and Iran (World Spider Catalog, 2021). The spider fauna of Iraq has not been studied in detail until now, many provinces of the country have not been studied at all, and therefore any material collected probably represent new records. During the study of newly collected material from Dhi Qar province, south of Iraq, we found specimens that belong to *P. redikorzevi* Spassky, 1940. The aim of this paper is to report that this species and the subfamily Prodidominae have been found in Iraq for the first time and to provide a detailed redescription of the female of *P. redikorzevi*.

Map 1. Global distribution of *Prodidomus redikorzevi* Spassky, 1940: two localities in Iran (square); two localities each in Azerbaijan and Kazakhstan (the latter is questionable) (dot); one locality each in Turkey (empty circle) and Turkmenistan (triangle); examined specimens (star) in Iraq.

Material and methods

The spiders were collected by hands from under dry mud piles in an agricultural land in Dhi Qar province, south of Iraq (Map 1). Specimens were studied and photographed by Nikon camera on an EZ4 stereomicroscope. Photographs of the epigyne were taken in a dish with white cotton at the bottom, filled with alcohol. The epigyne was cleared in a KOH/water solution until soft tissues were dissolved. All measurements are given in millimetres. Lengths of leg segments are given as: total length (femur, patella, tibia, metatarsus, tarsus). Identification depended on: Cooke (1964), Kunt *et al.* (2012), and Marusik (2010). Material examined deposited in the Invertebrate Laboratory, College of Basic Education, University of Sumer, Iraq.

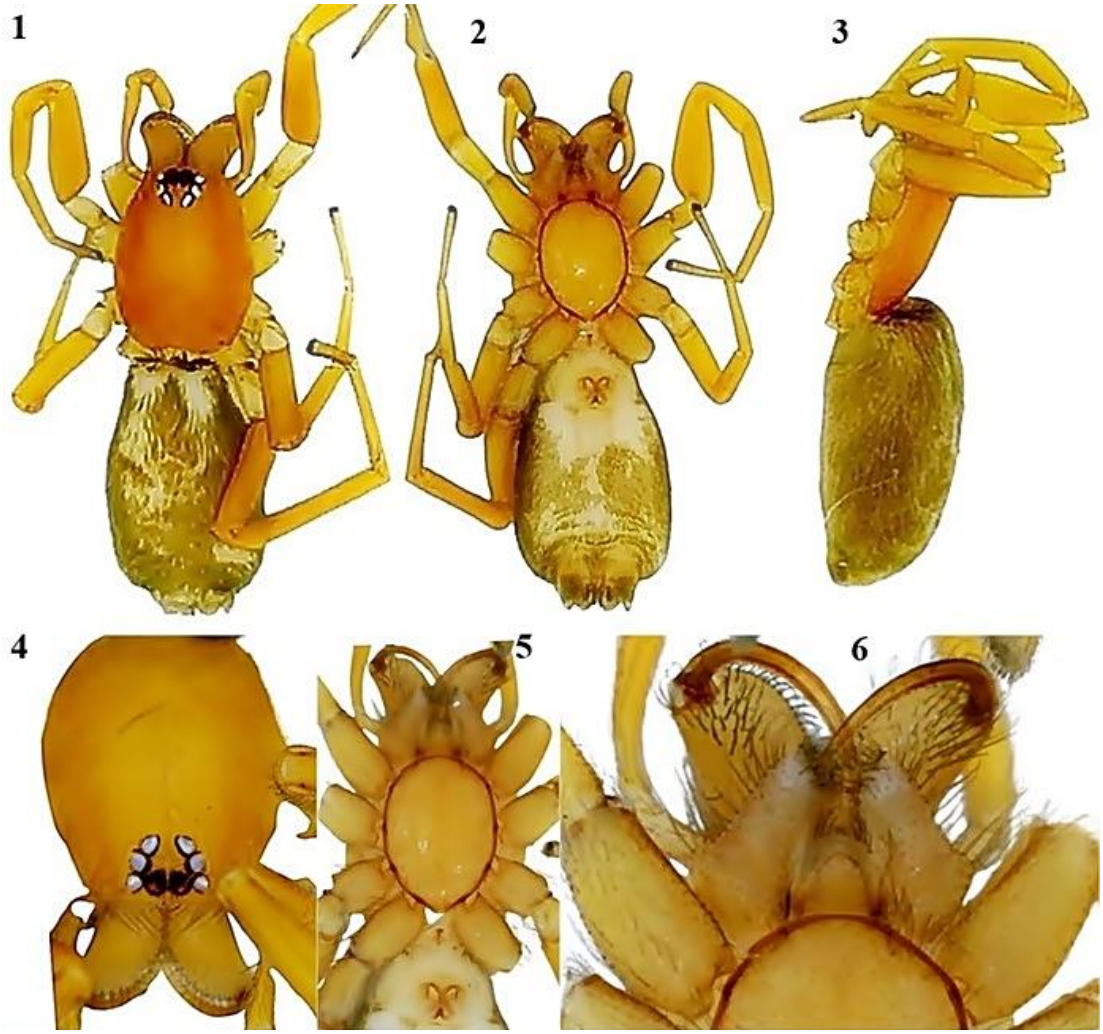
Taxonomy

Family **Gnaphosidae** Banks, 1892
Genus ***Prodidomus*** Hentz, 1847

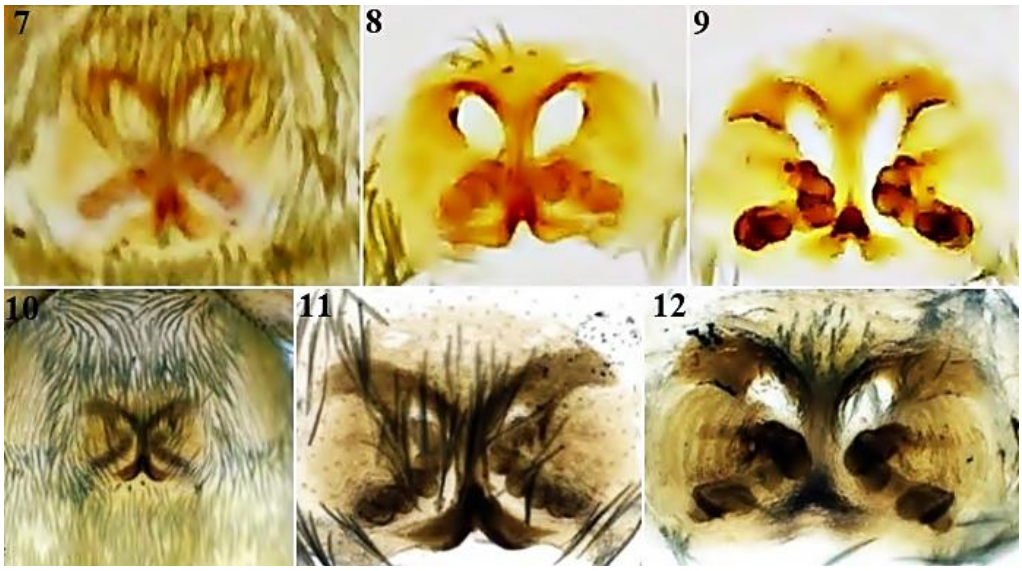
Prodidomus redikorzevi Spassky, 1940 (Figs. 1-12)
Prodidomus redikorzevi: Spassky, 1940: 362, pl. 7, f. 14-15 (D♀); Cooke, 1964: 279, f. 14 (♀); Marusik, 2010: 59, f. 1-17 (♀, D♂); Kunt *et al.*, 2012: 642, f. 9a-e (♀).

Material examined. 3♀♀, Iraq, Dhi Qar Province, Qalht Suker District, agricultural Land, under dry mud piles (31°51'26.35"N, 46°04'53.52"E), 17 January 2020, leg. AL-Khazali.

Diagnosis: The females of this species can be distinguished from other *Prodidomus* species by vulva with three coils insemination duct. For male diagnosis see Marusik (2010).



Figs. 1-6. *Prodidomus redikorzevi* Spassky, 1940 ♀. 1-3. habitus. 4-5. prosoma. 6. chelicerae. [1, 4. dorsal view. 2, 5-6. ventral view. 3. lateral view.]



Figs. 7-12. *Prodidomus redikorzevi* Spassky, 1940 ♀, epigyne. 7-9. specimen from Iraq. 10-12. specimen from Turkey, after Kunt *et al.* (2012: figs. 9c-e) for comparison. [7,10. intact, ventral view. 8-9, 11-12. macerated. 8,11. ventral view. 9,12. dorsal view.]

Description. Female. General appearance as in Figs. (1-3).
Measurements: Total length, 3.79. Carapace: 1.74 long, 1.16 wide. Abdomen: 2.05 long, 1.27 wide. Legs: I: 3.19 (0.92, 0.35, 0.76, 0.62, 0.54). II: 2.26 (0.62, 0.37, 0.49, 0.43, 0.35). III: 2.10 (0.62, 0.17, 0.61, 0.41, 0.29). IV: 1.69 (0.56, 0.12, 0.41, 0.32, 0.28).
Carapace ovoid, red-brownish (Fig. 4). Eyes arranged in 3 rows, ocular area triangle shaped, anterior median eyes dark and rounded, posterior lateral eyes largest. Sternum ovoid, lighter than carapace, with darker edges (Fig. 5). Chelicerae, endites, labium and legs red-brownish (Fig. 6). Abdomen elongated, brown without patterns, covered dorsally and ventrally with thick brown hairs (Figs. 1-3).
Distribution: Azerbaijan, Turkmenistan, Kazakhstan, Turkey, Iran, and Iraq.

Acknowledgments

My gratitude is to Alexander A. Fomichev (Barnaul, Russia) for his comment on the first draft.

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A new species of *Asemonea* O. Pickard-Cambridge, 1869 from Bangladesh (Araneae: Salticidae: Asemoneinae)

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Abstract

A new species of jumping spider, *Asemonea mirpurensis* n. sp. of the family Salticidae is described and illustrated. Generic diagnosis and distribution are provided together with the description of the species.

Keywords: Araneae, Salticidae , Asemoneinae, *Asemonea*, new species, Bangladesh.

Introduction

Family Salticidae is one of the common and fascinating groups of spiders available in the agricultural fields, gardens, and forests. They are cosmopolitan in distribution and currently contains over 6300 species under 658 genera in the world fauna (World Spider Catalog, 2021). Spiders of the genus *Asemonea* O. Pickard-Cambridge, 1869 are commonly found in the garden and forests of Bangladesh. These spiders are distributed in the Afrotropical, Oriental, and Australian regions (Wesołowska & Szűts, 2003). They cannot make any web but can freely jump from one plant to another for preying. Some members can make typical nests by folding leaves of plants during breeding season and the female stay within the nest with her eggs in peculiar manner.

These spiders are usually found among leaves and well distinguished by the longish, translucent light yellow or green colouration (Prószyński, 1984). Some of them use a sheet-web in capturing preys (Wanless, 1980; Hallas & Jackson, 1986) within plants.

The genus *Asemonea* was first established by O. Pickard-Cambridge in 1869 with the type-species *Lyssomanes tenuipes* O. Pickard-Cambridge, 1869. It comprises at

present a total of 23 species in the world fauna (World Spider Catalog, 2021) and only six species in the Asian countries but there is no record of these in the fauna of Bangladesh (Biswas & Biswas, 1992; Biswas *et al*., 1993; Okuma *et al.*, 1993; Barrion & Litsinger, 1995; Ikeda, 1996; Begum & Biswas, 1997; Szűts, 2000; Wesołowska & Szűts, 2003; Tang *et al.*, 2006; Biswas, 2009, 2019, 2020; Wesołowska & Haddad, 2013; Roy *et al*., 2016; Sudhin *et al.*, 2020). The present paper contains an illustrated description of a new species *A. mirpurensis* n. sp. from Dhaka, Bangladesh with generic diagnosis and distribution. The genus *Asemonea* O. Pickard-Cambridge is recorded for the first time from Bangladesh.

Bangladesh is rich in jumping spider fauna in different ecosystems. As *Asemonea* is a forest spider genus, its number of species must be increased in the future studies and will help in the conservation practices of the endangered spiders of the country. Also, these spiders are among important predators of forest insect pests. So, continuous study on such a natural bio-control agent will be helpful for future forest insect pest-management practices in Bangladesh.

Material and Methods

The study was made with the collection of specimens from the National Botanical Garden, Mirpur, Dhaka, Bangladesh. After sorting, the specimens were preserved primarily in 70% ethyl alcohol and after identification were finally preserved in 'Audman's preservatives' (90 parts 70% alcohol + 5 parts glacial acetic acid + 5 parts glycerine) following Lincoln & Sheals (1985) and Tikader (1987). The specimens are presently preserved in the collection of the Department of Zoology, Khulna Government Womens' College, Khulna-9000, Bangladesh and will be deposited in the Museum of the Department of Zoology, University of Dhaka (KGWC), in due course of time.

All the necessary body-parts (viz. – Chelicerae, maxillae, labium, pedipalps, etc.) are dissected out and illustrated under stereozoom binocular microscope. Pedipalps are dissected and boiled in 10% KOH for 3-5 minutes following Levi (1965) and Tikader (1987). Leg measurements are given in the following sequence: femur, patella, tibia, metatarsus, tarsus, and total length. All measurements are taken in millimetres. Necessary photographs are taken with DSLR Nikkon Camera fitted with macrozoom lens.

Identification references consulted are: Wanless (1980), Tikader & Biswas (1981), Prószyński (1984), Tikader (1987), Peng *et al.* (1993), Barrion & Litsinger (1995), Song *et al.* (1999), Maddison (2015), Roy *et al.* (2016), and Wesołowska (2001).

Taxonomy

Family **Salticidae** Blackwall, 1841
Subfamily **Asemoneinae** Maddison, 2015
Genus ***Asemonea*** O. Pickard-Cambridge, 1869
Type-species *Lyssomanes tenuipes* O. Pickard-Cambridge, 1869

Diagnosis: Body elongate, small to medium in size. Total length ranges between 2 to 7 mm. Colour mostly translucent light yellow to green. Carapace longer than broad, low to moderately high with elevated eye region, posteriorly widest. Eyes arranged in 4 transverse rows (rows two and three close), with broad black bands except anterior medians (AME), set on moderately well-developed tubercles; AME the largest, almost occupying full breadth of the face. Chelicerae small to medium in size, moderately robust, vertical or inclined posteriorly, promargin with 2-3 teeth and retromargin with 5-7

teeth. Maxillae medium in length. Labium subtriangular, usually wider than long, about ½ or less than half of maxillary length. Sternum cordiform, margin not clearly distinct. Abdomen elongate oval or dumbbell shaped clothed with minute iridescent setae. Spinnerets rarely subequal in length, posteriors usually largest with long and slender hinges occasionally present. Male palpal femora with ventral furrow, fringed in setae, cymbium moderately due, embolus long, curved and slender, arising from base of tegulum. Epigynal atrium undivided in the middle of spermathecae more or less ovoid with lanceolate fertilization septum or covered by median scape. Adults are beautifully coloured and attractive. Sometimes sexual dimorphism is evident in colour markings and presence of ornate fringes in males (Wanless, 1980).

Biological note: Spiders of genus *Asemonea* are commonly found among leaves of garden and forests. They cannot spin any web but can jump from one place to another for preying. During breeding season, especially in winter, they make a typical nest and stay within it with eggs up to the emergence of the spiderlings. Some species use sheet-webs in capturing preys (Hallas & Jackson, 1986).

Distribution: Most sub-Saharan African countries (Angola, Ghana, Mali, Kenya, Liberia, etc.), South Asia (Bangladesh, Myanmar, India, Sri Lanka, Nepal, Malaysia, Thailand, Singapore, Japan, and China), and introduced to Australia (Queensland) (World Spider Catalog, 2021).

Asemonea mirpurensis n. sp.

(Figs. 1-2)

Material examined: Holotype: 1♂, Botanical garden, Mirpur, Dhaka, Bangladesh. 18.08. 2017, Coll. Nusrat Jahan.
Paratype: 1 ♂, same data as for the holotype.
Type-locality: National Botanical Garden, Mirpur, Dhaka, Bangladesh; collected from the leaves of shrubs in the morning.

All specimens are now in the collection of KGWC, Khulna and will be deposited in the Museum of the Department of Zoology, University of Dhaka, Bangladesh.

Description of the male holotype (Figs. 1-2)**:** Body very small. Cephalothorax blackish-brown, legs light yellowish and abdomen dark brown with a posterior reddish band. Total body length 5.20. Carapace 1.98 long, 1.80 wide. Abdomen 3.22 long and 1.35 wide.
Cephalothorax: Carapace dark blackish-brown, broad, oval, slightly longer than wide, medially elevated, posteriorly narrowing, clothed with brown small setae and pubescence. Eyes pearly-white, dissimilar, anterior row of eyes recurved; anterior medians nearly 5 times larger than the anterior laterals; 2nd row of eyes brown, minute, placed little far from the anterior row; posterior row of eyes large, straight, placed marginally. Chelicerae brown, broad basally, strong, each of inner and outer margins with 5 and 3 teeth (Fig. 2c). Maxillae brown, anteriorly wide, base narrow, scopulate anteriorly (Fig. 2d). Labium brown, broad, nearly globular, scopulate anteriorly (Fig. 2e). Sternum brown, wide anteriorly and posteriorly narrow, anterior margin concave (Fig. 2f). Legs long and slender, yellowish, covered with spines (Fig. 1a); leg formula 4132 and the measurements (in mm) as in Table (1). Male palp black as in figs. (1a-c, 2a-b).

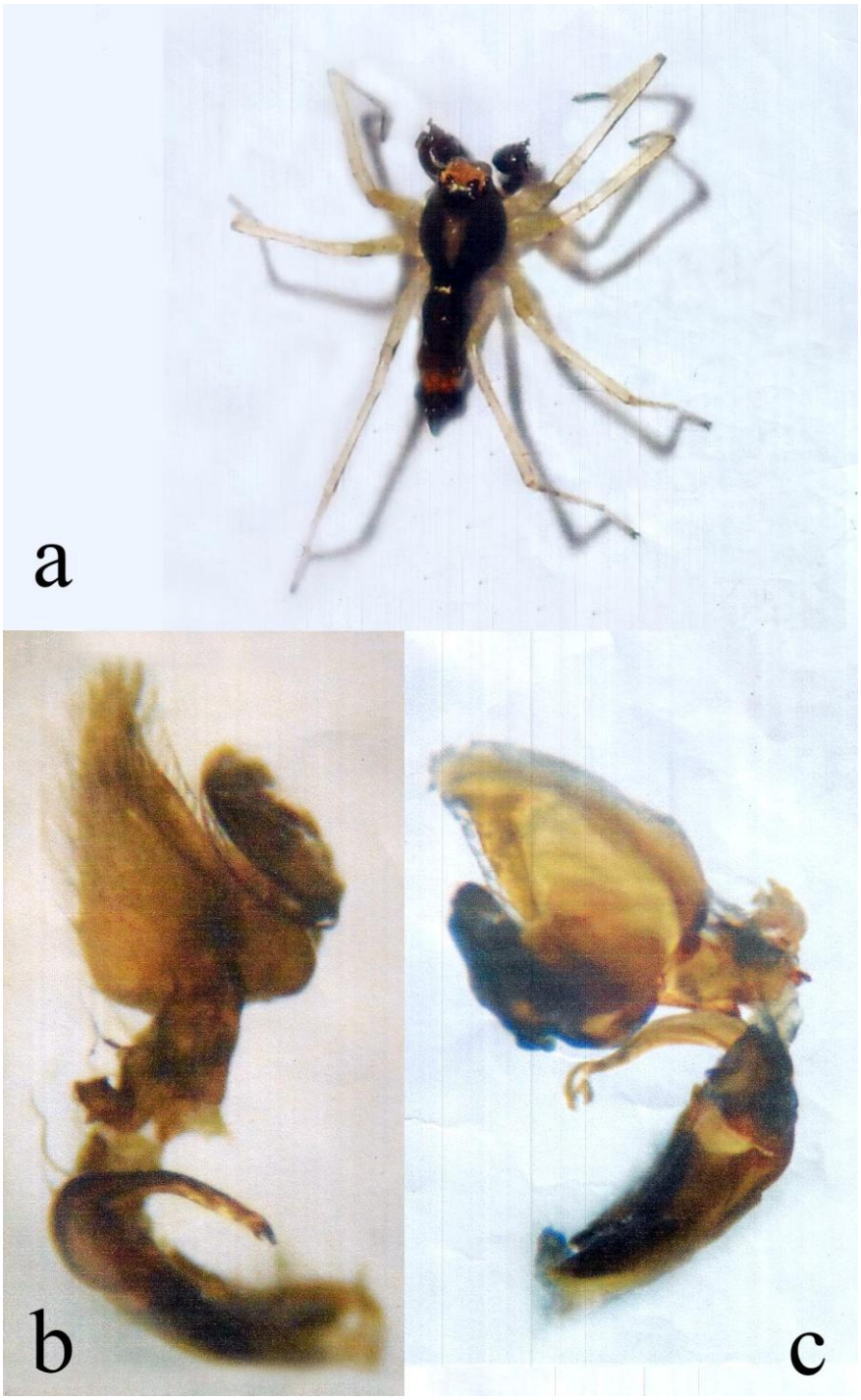

Fig. 1. *Asemonea mirpurensis* n. sp. ♂. a. habitus, dorsal view. b-c. Male palp. b. lateral view. c. ventral view.

Table 1. Measurements of leg segments of *Asemonea mirpurensis* sp. n. ♂.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	1.68	0.45	1.60	1.43	0.65	5.81
II	1.54	0.35	1.48	1.38	0.62	5.37
III	1.57	0.40	1.50	1.41	0.64	5.52
IV	1.72	0.50	1.92	1.50	0.72	6.36

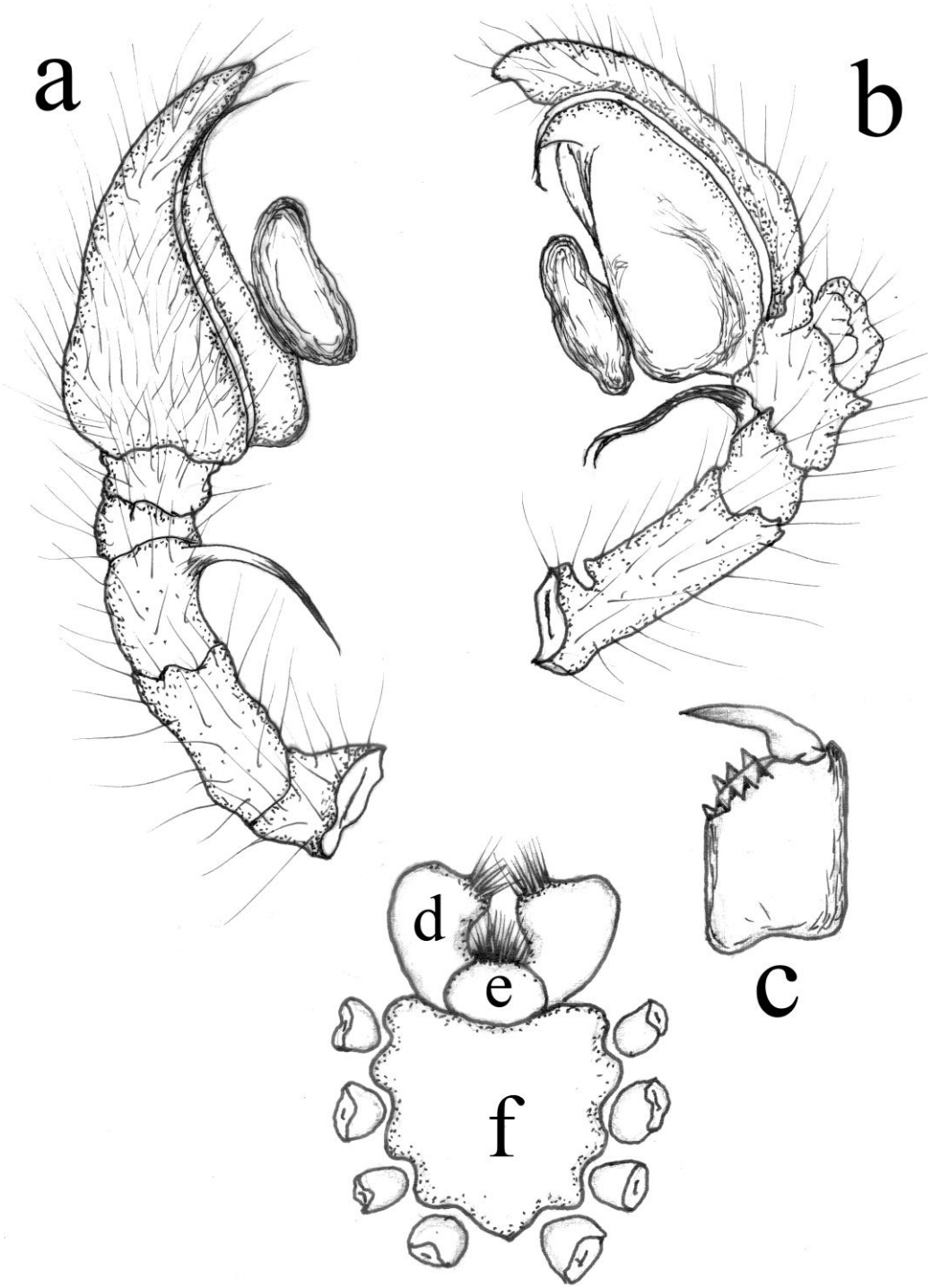

Fig. 2. *Asemonea mirpurensis* n. sp. ♂. a-b. Male palp. a. lateral view. b. ventral view. c. Chelicera. d. Maxilla. e. Labium. f. Sternum.

Abdomen: long, dumbbell shaped, blackish-brown in colour with wavy margins, posteriorly with a reddish band before the end; terminal end elongately pointed; dorsum covered with hairs; spinnerets blackish, elongate; ventrally light-brown.

Female: Unknown.
Etymology: The species is named after the name of the type-locality "Mirpur".

Diagnosis: The present species *Asemonea mirpurensis* n. sp. does not show similarity with none of its adjacent Indian congeners: *Asemonea cristata* Thorell, 1895 (Wanless, 1980; Biswas & Biswas, 1992 [as *A. santinagarensis*]; Sudhin *et al.*, 2020) and *Asemonea tenuipes* O. Pickard-Cambridge, 1869 (Wanless, 1980; Roy *et al*., 2016). However, the known *Asemonea* species of the world fauna (Wanless, 1980; Hallas & Jackson, 1986; Barrion & Litsinger, 1995; Ikeda, 1996; Sudhin *et al.*, 2020; Szűts, 2000; Wesołowska, 2001, 2009; Peng & Li, 2002; Wesołowska & Szűts, 2003; Zhang *et al.*, 2004; Tang *et al.*, 2006; Ono *et al.*, 2009; Wesołowska & Haddad, 2013) do not show similarity with the present species. Also, the external body form and structure of male palp of the present species is different from the known described ones. Therefore, the present species is described as new to science.

Acknowledgments

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***Asemonea mirpurensis* Jahan & Biswas, 2021**
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Serket (2021) vol. 18(1): 47-52.

Description of a new species of *Uloborus* Latreille, 1806 (Araneae: Uloboridae) from Shendurney Wildlife Sanctuary of Western Ghats, India

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Abstract

A new species *Uloborus shendurneyensis* sp. n. is described from Shendurney wildlife sanctuary of south India. A detailed description, diagnostic features and illustrations of both sexes are given. Collecting localities of all *Uloborus* species from India are mapped.

Keywords: Uloboridae, New species, Shendurney wildlife sanctuary, India.

Introduction

Family Uloboridae Thorell, 1869 is a unique group of spiders lacking poison glands. They are small to medium sized, eight-eyed, three clawed and are the only orb-web spinning cribellate spiders. Fourth metatarsi dorsally compressed and curved under uniseriate calamistrum and having rows of long trichobotheria (Sebastian & Peter, 2009). The family Uloboridae is represented by 289 species under 19 genera worldwide (World Spider Catalog, 2021), of which 22 species under 5 genera are known from India (Chatterjee *et al.*, 2018). Genus *Uloborus* was established by Latreille (1806) on the basis of the type species *Uloborus walckenaeirius* Latreille, 1806. Currently, the genus *Uloborus* consists of nine valid species from India (World Spider Catalog, 2021), all of them are known as females while the males of only three of them are described. In the present paper, we diagnose and describe a new *Uloborus* species from Shendurney wildlife sanctuary of Western Ghats, India.

Material and Methods

The present paper is based on the handpicked spider specimen preserved in 70% alcohol. It was later examined and photographed by Optika stereomicroscope. All images were then processed with the aid of Optika vision Lite 2.1 software. All measurements are in mm. The length of the leg segments and palps are given as follows: total length (femur, patella, tibia, metatarsus [except for palps], tarsus). The studied specimens are deposited in the reference section of museum of the Department of Zoology, University of Kerala, Kariavattom, India (KUDZ). Abbreviations used in the text are as follows: ALE = anterior lateral eye, AME = anterior median eye, PLE = posterior lateral eye, PME = posterior median eye, I-IV = 1st to 4th legs.

Figs. 1-10. *Uloborus shendurneyensis* sp. n. ♀, somatic characters and copulatory organs. 1-4. Holotype (KUDZEN2021.I.02a). 1-3. habitus. 1. dorsal view. 2. ventral view. 3. lateral view. 4. carapace frontal view. 5-10. Paratype (KUDZEN2021.I.02c). 5-7. epigyne. 5-6. ventral view. 7. dorsal view. [6-7. cleared.] 8. calamistrum, lateral view. 9. sternum with tuft of hairs apico-laterally. 10. tibia I, dorso-lateral view.
Scale bars: 1-3, 9-10 (1 mm); 4, 8 (0.5 mm); 5-7 (0.2 mm).

Taxonomy

Family **Uloboridae** Thorell, 1869
Genus ***Uloborus*** Latreille, 1806
Type-species *Uloborus walckenaeirius* Latreille, 1806

Uloborus shendurneyensis sp. n.
(Figs. 1-20)

Types: Holotype ♀ (KUDZEN2021.I.02a) from Kattalapara, Kulathupuzha, Shendurney wildlife sanctuary of Western Ghats, Kollam district, Kerala, India (08°54'10.0"N, 077°06'47.7"E), hand collecting, 21.01.2021, A. Asima.
Paratypes 1♂ (KUDZEN2021.I.02b), 1♀ (KUDZEN2021.I.02c) together with the holotype.

Etymology. The specific epithet is referring to the name of the sanctuary.

Diagnosis. The female of *U. shendurneyensis* sp. n. can be distinguished from those of *U. jabalpurensis* Bhandari & Gajbe, 2001 by the following combination of characters: cephalothorax with light median and lateral bands covered with light hairs vs. cephalothorax without any light bands in *U. jabalpurensis*; abdomen mid-dorsally provided with a pair of white spots vs. abdomen mid-dorsally provided with a conspicuous blackish marking; sternum light brown with tuft of hairs antero-laterally vs. sternum yellowish white and densely clothed with hairs; leg I with a spine opposite to the calamistrum vs. no spine opposite the calamistrum. Other Indian *Uloborus* species are also different.

Description. **Female** (holotype, Figs. 1-5; paratype, 6-10, 17-18). Colouration of live specimens: carapace longer than wide, brown with light median and lateral bands covered with light hairs; abdomen oval, longer than wide, brown with two light bands emerging anteriorly leaving a cross shaped marking and merges at the middle and run posteriorly. A pair of white spots on either side of the light band at middle, white and dark patches on the lateral side (Fig. 3). Colouration of specimens preserved in alcohol: carapace dark brown with light median and lateral bands. Eyes: in two rows, anterior eyes recurved, AME are located on tubercles, posterior eyes in relatively straight line. Abdomen dark brown with two light bands emerging anteriorly leaving a cross shaped marking and merges at the middle and run posteriorly, anterior dorsal side provided with a hump. A pair of white spots on either side of the light band at middle, white bands on anterior lateral side, dark bands on posterior lateral side, spinnerets brown, chelicerae yellowish brown, endites and labium light brown and sternum elongated, rebordered, dark brown with tuft of hairs antero-laterally. Ventrum light brown with two light stripes from the lateral sides of book lungs joined by horizontal light strip just above the cribellum. Cribellum oval and complete. Anal tubercle prominent and relatively long. Legs I-IV light brown and enlarged except for tarsus and metatarsus. Legs with dark joints except for I-II. Metatarsi IV slightly curved where calamistrum is placed. Calamistrum is placed laterally at a small distance from the origin of metatarsus and does not reach the tip. A spine is present on the opposite to the calamistrum. Tibia I possess seven spines dorso-laterally. Body length 4.0. Carapace length 1.2, width (at the middle) 0.77, height (at the middle) 0.62. Abdomen length 2.8, width (at the middle) 1.05. Eye diameter: ALE 0.17, AME 0.27, PLE 0.16, PME 0.12. Eye inter distances: AME-AME 0.34, AME-ALE 0.49, ALE-ALE 1.25, ALE-PME 1.15, PLE-PLE 1.24, PME-PME 0.51, PME-PLE 0.33. Clypeus height at ALE 0.13, at AME 0.23. Chelicera length 0.87. Measurements of palp

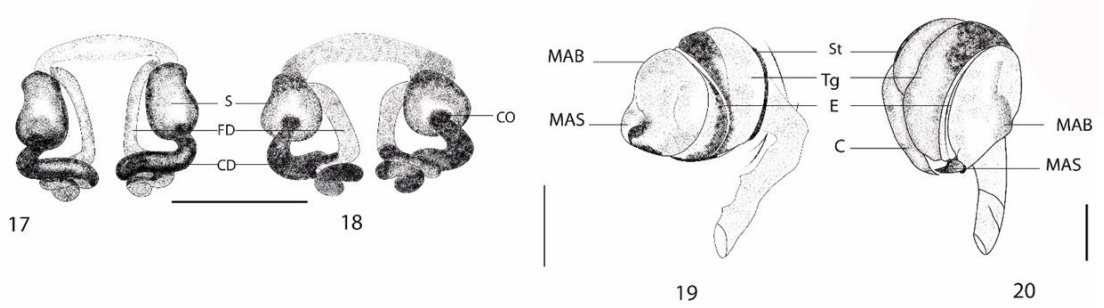
and legs. Palp 1.88 (0.61, 0.33, 0.30, 0.64), I 10.21 (3.24, 0.78, 2.37, 2.69, 1.13), II 7.67 (2.35, 0.60, 1.32, 2.11, 1.29), III 5.68 (1.77, 0.52, 0.92, 1.41, 1.06), IV 9.89 (3.12, 0.67, 2.15, 2.36, 1.59). Leg formula 1423. Epigyne as in Figs. (5-7, 17-18): widely oval in shape with short scape; copulatory duct short, horizontally oriented and smoothly curved; spermathecae subtriangular; fertilization duct large, converging and apico-laterally originated.

Figs. 11-16. *Uloborus shendurneyensis* sp. n. ♂, somatic characters and copulatory organs, (KUDZEN2021.I.02b). 11. habitus. 11. dorsal view. 12. ventral view. 13. carapace frontal view. 14-15. palp. 14. retrolateral view. 15. ventral view. 16. tibia I, dorsal view. Scale bars: 11-12 (1 mm); 13-15 (0.2 mm); 16 (0.5 mm).

Male (paratype, Figs. 11-16, 19-20) Colouration of live specimen: Carapace wider than long, orange with two reddish brown long bands wider anteriorly. Abdomen longer than wide light orange with dark orange brown patch in the posterior end. Colouration of specimen preserved in alcohol: Carapace light brown with two dark longitudinal bands. Two long and two short black lines radiating from fovea and extend to the dark bands. Eyes: anterior eyes recurved, AME located on tubercles, posterior eyes in relatively straight line. Abdomen light greyish with two lateral and one median short dark strip up to the middle. Ventrum light brown. Sternum as in female. Chelicerae, endites, labium light brown. Legs I-IV yellowish orange. Leg I longer than the others. Tibia I possess eleven spines dorso-laterally. Spinnerets long light brown. Cribellum triangular. Body length 3.2. Carapace length 1.5, width (at the middle) 1.2, height (at the middle) 0.8. Abdomen length 1.7, width (at the middle) 0.8. Eye diameter: ALE 0.09, AME 0.17, PLE 0.10, PME 0.12. Eye inter distances: AME-AME 0.34, AME-ALE 0.49, ALE-ALE 1.08, ALE-PME 0.53, PLE-PLE 1.07, PME-PME 0.45, PME-PLE 0.32. Clypeus height at ALE 0.58, at AME 0.37. Chelicera length 0.58. Measurements of palps and legs. Palp 1.91 (0.50, 0.31, 0.19, 0.91) I 7.14 (2.10, 0.36, 1.61, 2.28, 0.79) II 4.10 (1.20, 0.34, 0.75, 1.13, 0.68), III 3.05 (0.97, 0.24, 0.55, 0.74, 0.55), IV 4.95 (1.43, 0.36, 1.09, 1.22, 0.85). Leg formula 1423. Palp as in Figs. (14-15, 19-20): segments yellowish brown; cymbium

broad at base and narrows towards its tip; apically covered with small hairs; tegulum sclerotized; subtegulum located baso-prolaterally; embolus short, filiform and coils a single time.

Variation. The holotype and paratypes show no significant difference in the description parameters.



Figs. 17-20. *Uloborus shendurneyensis* sp. n., copulatory organs. ♀ (KUDZEN 2021.I.02c), 17-18. epigyne. 17. ventral view. 18. dorsal view. ♂ (KUDZEN2021.I.02b), 19-20. male palp. 19. retrolateral view. 20. dorsal view. Abbreviations: C = cymbium, CD = copulatory duct, CO = copulatory opening, E = embolus, FD = fertilization duct, MAB = median apophysis bulb, MAS = median apophysis spur, S = spermathecae, St = sub tegulum, Tg = tegulum. (Scale bars: 0.2 mm).

Distribution. Known only from the type locality, Shendurney wildlife sanctuary of Western Ghats, Kollam district, Kerala, India (Fig. 21).

Acknowledgments

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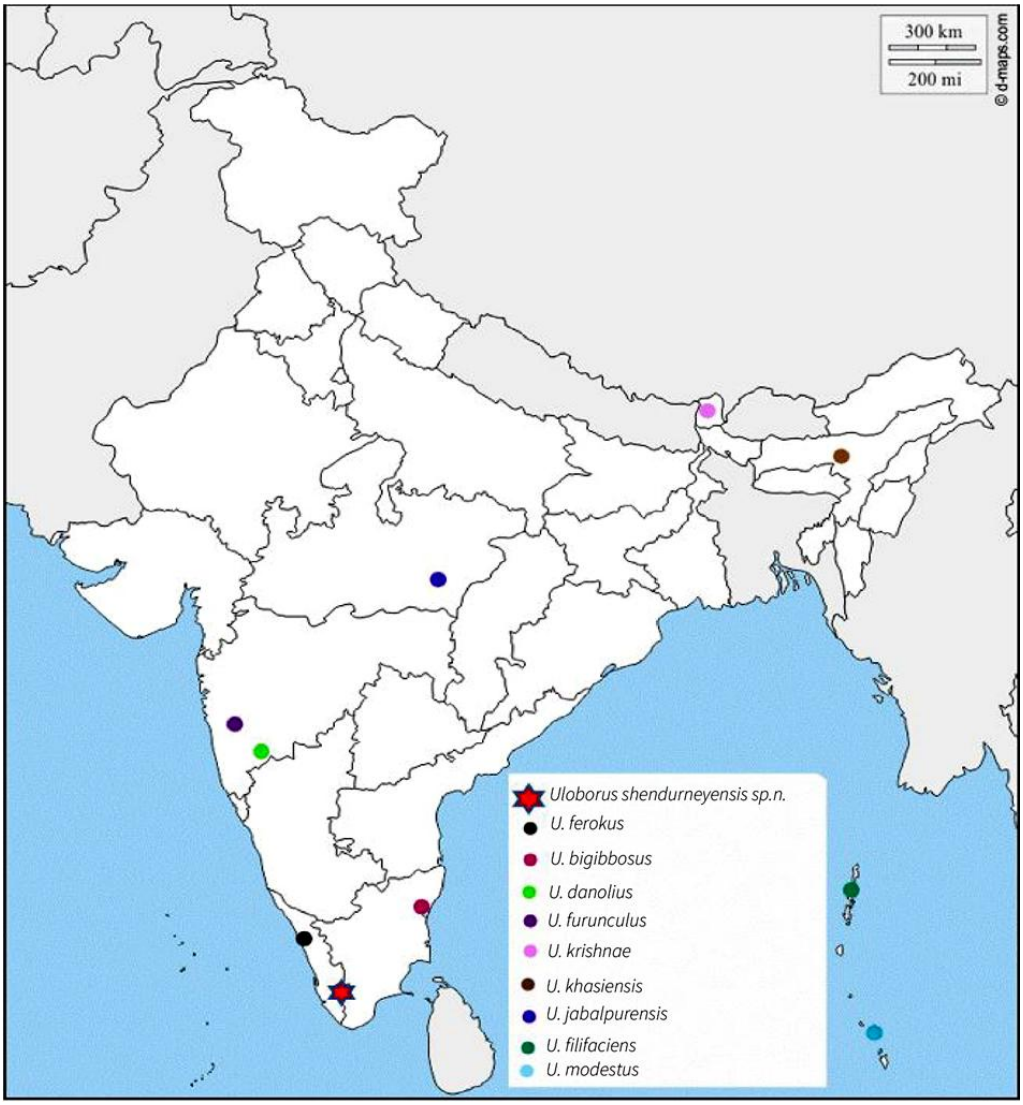

Fig. 21. Map of collecting localities of *Uloborus shendurneyensis* sp. n. and all other *Uloborus* species previously recorded in India.

***Uloborus shendurneyensis* Asima, Sudhikumar & Prasad, 2021**
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Diversity of spiders in Poovar mangrove ecosystem, Kerala, India

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Abstract

Spiders are one of the macro-invertebrate predators playing a vital role in maintaining the ecosystem balance. A preliminary study was conducted to record the spider fauna in a fragile ecosystem of Poovar, a mangrove centred tourist place in Thiruvananthapuram, the capital city of Kerala. The present study resulted 70 species of spiders from 45 genera and 16 families. The number of families obtained from the study represents 26% of the total families reported from India. Salticidae was the dominant family followed by Araneidae.

Keywords: Araneae, Salticidae, fragile ecosystem, checklist, guild, India.

Introduction

Spiders belong to the largest phylum Arthropoda and play an important role in maintaining ecosystem balance. The role of spiders in stabilizing arthropods population, especially hexapods is remarkable. The conservation strategies primarily focus on larger vertebrates, and the invertebrates are being ignored. Blackwall started the arachnological studies in India (Siliwal *et al.*, 2005). A study conducted by Sebastian *et al.* (2005) documented 51 species belonging to 16 families from Mangalavanam mangrove forest of Kerala. The current study was done on the spiders in Poovar mangrove ecosystem, Thiruvananthapuram, south India. Mangroves are the prime suspect of destruction due to pollution, unscientific developmental strategies, and climate change. Studying the flora and fauna of mangrove could improve the understanding about their importance in the

ecosystem. Arthropods are considered as indicator species for a long time likewise, spiders are also good indicators of the overall diversity and the health status of ecosystem. The diversity analysis of these major invertebrate predators can pave the way to a better understanding of both the general diversity and wellbeing of the ecosystem.

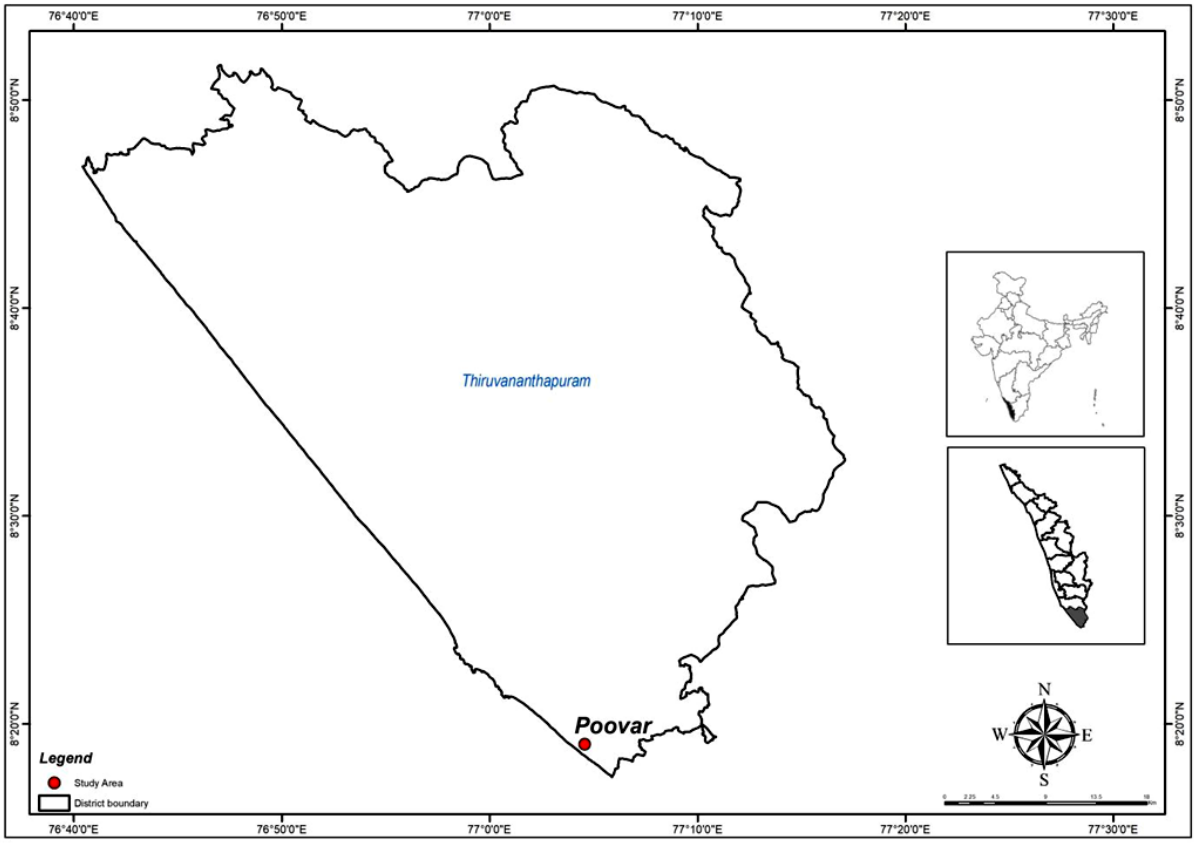

Plate 1. Map showing geographical location of Poovar mangrove ecosystem.

Material and Methods

Study area. Poovar is one among the tourist towns in the capital city of Kerala. The southernmost river of Kerala - Neyyar, originating from Agasthyamala joins the Lakshadweep sea at Poovar (08º19'01"N, 77º04'34"E), Thiruvananthapuram (Plate 1). The selected area was about 3 acres of almost circular land covered by water of Poovar estuary. The dispersion of vegetation follows an incomparable pattern, the mangrove plants and its associated flora are found at the circumference of the study area. *Acrostichum aureum*, *Adiantum latifolium*, *Alternanthera philoxeroides*, *Barringtonia racemosa*, and *Pandanus odorifer* are the major mangrove plants found in the study site (Vidyasagaran & Madhusoodanan, 2014).

Methods. The study was conducted from March to August 2019. Habitats which likely to support the existence of spiders were carefully searched. The collecting was done mainly by visual searching through line transect. Whole area made in to several transects of 25 metres length and 2.5 metres width to each side in regular intervals of 5 metres. Plants, logs, litter, and grass were searched for spiders. Adult specimens were identified using available literature (Barrion & Litsinger, 1995; Sebastian & Peter, 2009; World Spider Catalog, 2021). The identified species of spiders were categorized under different guilds (Cardoso *et al.*, 2011).

Table 1. Checklist of spiders collected from Poovar mangrove ecosystem.

No.	Family / species	Guild
I	**Araneidae**	
1	*Anepsion maritatum* (O. Pickard-Cambridge, 1877)	Orb web
2	*Arachnura angura* Tikader, 1970	Orb web
3	*Araneus mitificus* (Simon, 1886)	Orb web
4	*Araniella nympha* (Simon, 1889)	Orb web
5	*Argiope aemula* (Walckenaer, 1841)	Orb web
6	*Argiope anasuja* Thorell, 1887	Orb web
7	*Argiope pulchella* Thorell, 1881	Orb web
8	*Cyrtarachnea* sp.	Orb web
9	*Cyrtophora cicatrosa* (Stoliczka, 1869)	Orb web
10	*Cyrtophora moluccensis* (Doleschall, 1857)	Orb web
11	*Gasteracantha geminata* (Fabricius, 1798)	Orb web
12	*Neoscona mukerjei* Tikader, 1980	Orb web
13	*Neoscona* sp.	Orb web
14	*Parawixia dehaani* (Doleschall, 1859)	Orb web
II	**Cheiracanthiidae**	
15	*Cheiracanthium melanostomum* (Thorell, 1895)	Other hunters
16	*Cheiracanthium* sp.	Other hunters
III	**Clubionidae**	
17	*Clubiona drassodes* O. Pickard-Cambridge, 1874	Other hunters
18	*Clubiona* sp.	Other hunters
IV	**Eresidae**	
19	*Stegodyphus sarasinorum* Karsch, 1892	Sheet web
V	**Gnaphosidae**	
20	*Zelotes* sp.	Ground hunters
VI	**Hersiliidae**	
21	*Hersilia savignyi* Lucas, 1836	Sensing web
VII	**Lycosidae**	
22	*Hippasa agelenoides* (Simon, 1884)	Ground hunters
23	*Lycosa mackenziei* Gravely, 1924	Ground hunters
24	*Lycosa tista* Tikader, 1970	Ground hunters
25	*Lycosa* sp.	Ground hunters
VIII	**Oxyopidae**	
26	*Oxyopes birmanicus* Thorell, 1887	
27	*Oxyopes javanus* Thorell, 1887	Other hunters
28	*Oxyopes shweta* Tikader, 1970	Other hunters
29	*Oxyopes sunandae* Tikader, 1970	Other hunters
30	*Tapponia* sp.	Other hunters
IX	**Philodromidae**	
31	*Tibellus elongatus* Tikader, 1960	Other hunters
X	**Pisauridae**	
32	*Dendrolycosa* sp.	Sheet web
XI	**Salticidae**	
33	*Asemonea tenuipes* (O. Pickard-Cambridge, 1869)	Other hunters
34	*Carrhotus viduus* (C.L. Koch, 1846)	Other hunters
35	*Epeus indicus* Prószyński, 1992	Other hunters

36	*Epeus tener* (Simon, 1877)	Other hunters
37	*Epocilla aurantiaca* (Simon, 1885)	Other hunters
38	*Hyllus semicupreus* (Simon, 1885)	Other hunters
39	*Indopadilla insularis* (Malamel, Sankaran & Sebastian, 2015)	Other hunters
40	*Menemerus bivittatus* (Dufour, 1831)	Other hunters
41	*Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869)	Other hunters
42	*Phaeacius lancearius* (Thorell, 1895)	Other hunters
43	*Phintella vittata* (C.L. Koch, 1846)	Other hunters
44	*Plexippus paykulli* (Audouin, 1825)	Other hunters
45	*Plexippus petersi* (Karsch, 1878)	Other hunters
46	*Rhene flavicomans* Simon, 1902	Other hunters
47	*Rhene* sp.	Other hunters
48	*Siler semiglaucus* (Simon, 1901)	Other hunters
49	*Telamonia dimidiata* (Simon, 1899)	Other hunters
50	*Thiania bhamoensis* Thorell, 1887	Other hunters
XII	**Sparassidae**	
51	*Heteropoda venatoria* (Linnaeus, 1767)	Other hunters
52	*Olios* sp.	Other hunters
XIII	**Tetragnathidae**	
53	*Leucauge decorata* (Blackwall, 1864)	Orb web
54	*Leucauge tessellata* (Thorell, 1887)	Orb web
55	*Tetragnatha ceylonica* O. Pickard-Cambridge, 1869	Orb web
56	*Tetragnatha mandibulata* Walckenaer, 1841	Orb web
57	*Tylorida ventralis* (Thorell, 1877)	Orb web
XIV	**Theridiidae**	
58	*Achaearanea* sp.	Space web
59	*Argyrodes flavescens* O. Pickard-Cambridge, 1880	Space web
60	*Argyrodes kumadai* Chida & Tanikawa, 1999	Space web
61	*Argyrodes* sp.	Space web
62	*Ariamnes flagellum* (Doleschall, 1857)	Space web
63	*Steatoda* sp.	Space web
XV	**Thomisidae**	
64	*Oxytate virens* (Thorell, 1891)	Ambush hunters
65	*Oxytate* sp.	Ambush hunters
66	*Thomisus lobosus* Tikader, 1965	Ambush hunters
67	*Thomisus projectus* Tikader, 1960	Ambush hunters
68	*Thomisus pugilis* Stoliczka, 1869	Ambush hunters
XVI	**Uloboridae**	
69	*Miagrammopes extensus* Simon, 1889	Orb web
70	*Uloborus* sp.	Orb web

Results

A total of 70 species belonging to 54 genera and 16 families were identified from the Poovar mangroves and associated ecosystem (Table 1). Salticidae was the dominant family comprising 17 species from 13 genera. Araneidae forms the second dominant family consisting 14 species from 9 genera followed by Thomisidae and Tetragnathidae (Fig. 1). The number of families obtained from the study represents 26% of the total families reported from India (Caleb & Pradeep, 2021). Guild structure (Cardoso *et al.*,

2011) prevailed 7 different feeding guilds (Fig. 2): orb web, space web, sensing web, sheet web, ambush hunters, ground hunters, and other hunters. Other hunters is the dominants guild (38%) found, comprising 6 families. Orb web and sheet web weavers forming the next dominant feeding guilds with 13% and 12% of the total guild composition. Six species were found to be endemic to India (and sometimes the adjacent countries: Bangladesh, Nepal, and Pakistan) including *Neoscona mukerjei*, *Lycosa tista*, *Tibellus elongatus*, *Epeus indicus*, *Thomisus projectus*, and *Miagrammopes extensus*.

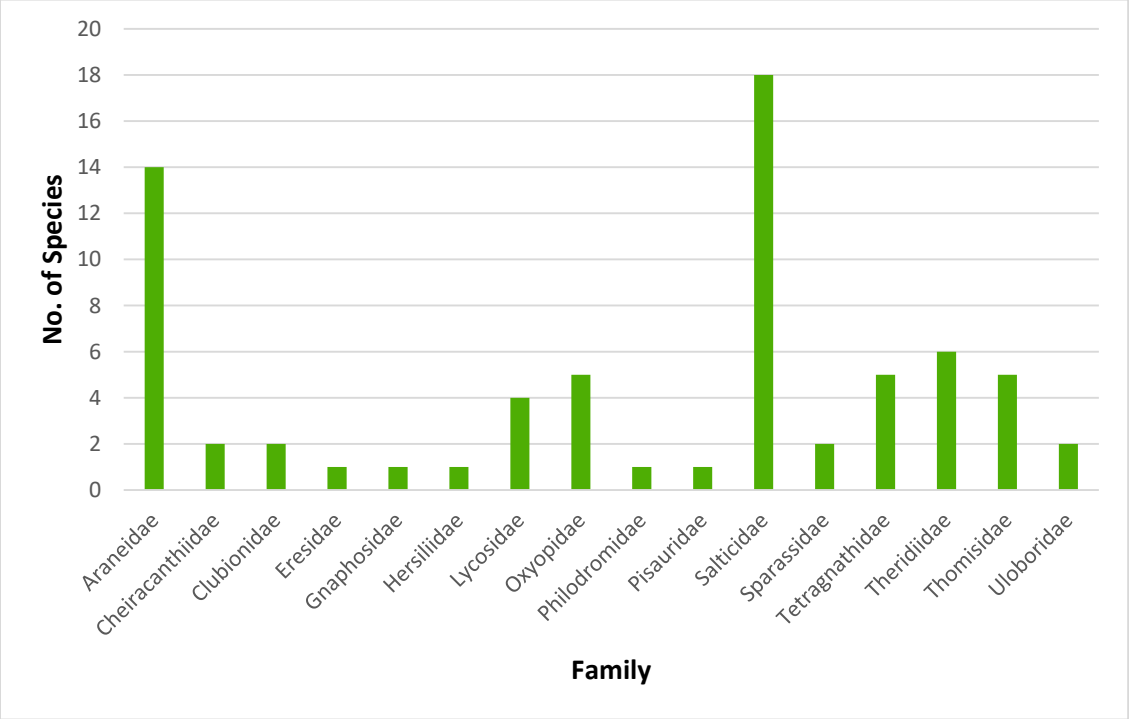

Fig. 1. Family wise abundance of species collected from Poovar mangrove ecosystem.

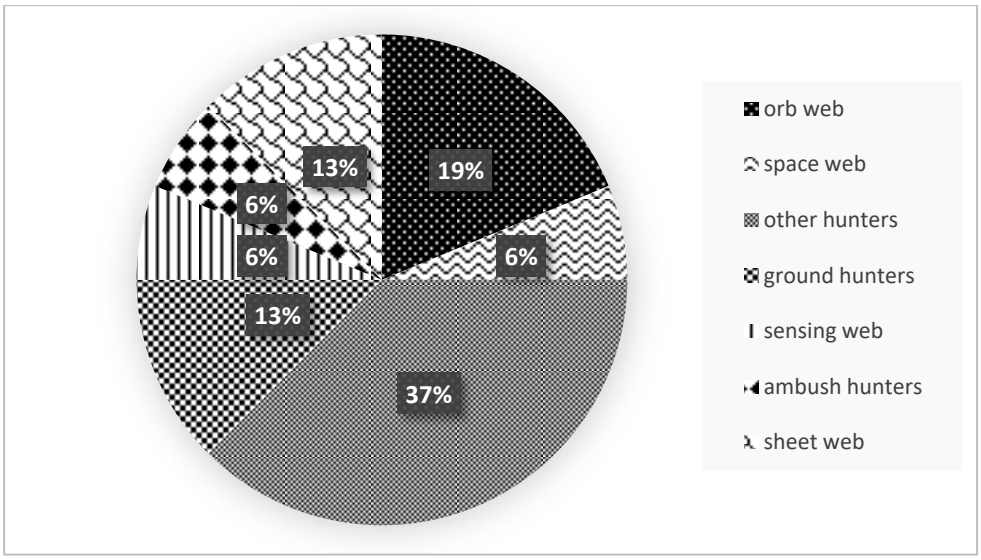

Fig. 2. Guild composition of spiders collected from Poovar mangrove ecosystem.

Discussion

The study discloses an important fact that Poovar mangrove ecosystem holds a tremendous araneofauna along with many hexapods, native and migratory birds (Mahanti & Kumar, 2017). This is the first attempt to explore the diversity of spiders in the Poovar mangroves. Mangroves are very delicate yet ideal habitat for many organisms including spiders. This plenteous diversity of spiders are also indicating the overall biodiversity and the health status of the biome (Noss, 1990), as they can quickly respond to sudden changes occurring in the ecosystem in community level or even in species level (Marc *et al.*, 1999). As per the study, Poovar mangrove ecosystem holds rich diversity of spiders. This emphasizes the importance for keeping this ecosystem undamaged. Spiders have enormous number of foraging strategies. Hence, they can be sorted in to different feeding guilds (Uetz *et al.*, 1999). The predominant guild obtained from the present study is other hunters. Ambush hunters, space web builders, and sensing web builders are the three guilds which seem very low in the study area. Analyzing the araneofauna can strongly emphasize not only their protection but the conservation of the entire biome.

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First report of the small daddy long leg spider *Micropholcus fauroti* (Simon, 1887) (Araneae: Pholcidae) female from India with redescription of the male

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Abstract

Pholcids are the commonly and abundantly occurring synanthropic spiders with worldwide distribution. Small daddy long leg spider *Micropholcus fauroti* (Simon, 1887) has been reported from many countries across the globe. So far only male of *M. fauroti* has been reported from Poona, India. In the present study, female of *M. fauroti* is reported for the first time from India.

Keywords: *Micropholcus fauroti*, Daddy long leg spider, synanthrope, first report, India.

Introduction

Long legged spider genus *Micropholcus* Deeleman-Reinhold & Prinsen, 1987 belongs to family Pholcidae which presently includes 1842 named species (World Spider Catalog, 2021) with about 4000-5000 estimated species worldwide (Huber *et al.*, 2017). This versatile group of spiders inhabit from leaf litters to tree canopies and from dark caves to most modern buildings. Many members of this family are often confused with daddy long legs of order opiliones because of the exceptionally elongated and pseudo-segmented legs (Huber, 2009). Modern taxonomic practices including molecular phylogeny made this group more precise and vivid by shifting, merging and synonymizing many genera. Pholcidae include small to medium ecribellate spiders with six or eight eyes usually with very long fragile legs having a pseudosegmented tarsi ending in three claws. The current studies regarding Indian pholcids ensures 6 genera and

13 species (Caleb & Sankaran, 2021). The genus *Pholcus* is the most dominant genus with 7 identified species presently.

In 1987, Deeleman-Reinhold & Prinsen established the genus *Micropholcus*, that it was previously included in the genus *Pholcus*. Now the genus contains 17 species (World Spider Catalog, 2021). Spiders coming under the family Pholcidae are skilled, they became diversified and successful along with humans, since they are known as synanthropic web builders of neotropics. *Crossopriza lyoni* (Blackwall, 1867), *Modisimus culicinus* (Simon, 1893), *Pholcus phalangioides* (Fuesslin, 1775), *Physocyclus globosus* (Taczanowski, 1874), and *Micropholcus fauroti* (Simon, 1887) are some of the most flourishing species (Huber, 2009).

Material and Methods

Most of the specimens were collected by visual searching and handpicking method around the room corners and ceilings. The specimens are directly collected into plastic vials having 70% ethanol. Morphological examination was undertaken under a Leica M205 C stereomicroscope. The digital images were taken by means of Leica DMC4500 digital camera attached to Leica M205 C stereomicroscope, with the software package Leica Application Suite (LAS), version 4.3.0. LAS montage facility. All measurements are in millimetres. Measurement data for palps and legs are as follows: total length [femur, patella, tibia, metatarsus (except palp), tarsus]. The specimens studied are housed in the Centre for Animal Taxonomy and Ecology (CATE), Department of Zoology, Christ College (Autonomous), Irinjalakuda, Kerala, India.

Taxonomy

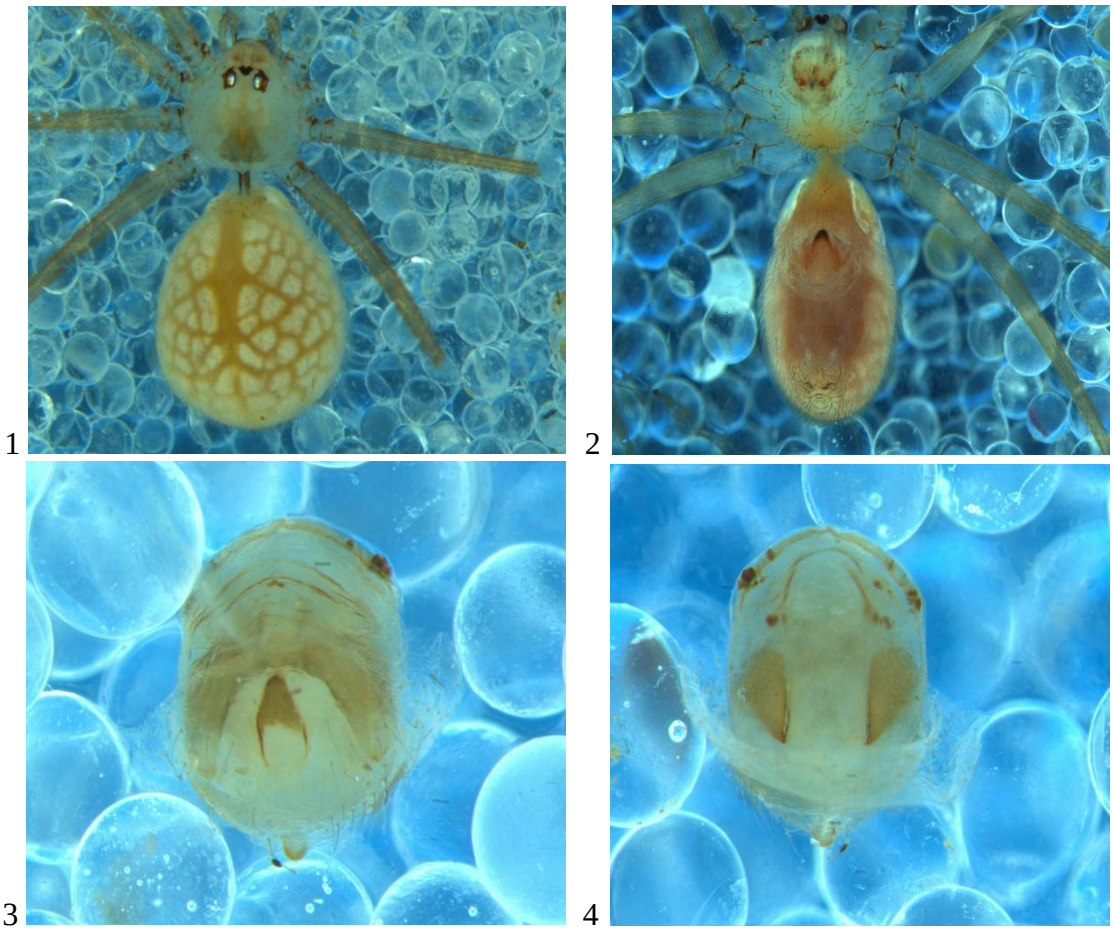
Family **Pholcidae** C.L. Koch, 1850
Genus ***Micropholcus*** Deeleman-Reinhold & Prinsen, 1987

Type-species ***Micropholcus fauroti*** (Simon, 1887)
(Figs. 1-8)

Diagnosis. Small sized pale spiders with globose abdomen. Cephalothorax is broader than long. The eye region is slightly elevated with eight eyes. Small anterior median eyes arranged as a dyad and the others in two triads. The pedicel has a characteristic 'V' shaped black marking. Abdomen with irregular light patterns. Male with a characteristic palpal bulb, cymbium with large paracymbium and female epigyne is located on a knob like elevated region of ventral side of the abdomen (Huber, 2000, 2011). Males are somewhat smaller than the females.

Material examined. 3 ♂♂, 5 ♀♀ (CATE 874808) Christ college campus, Irinjalakuda, Kerala (10º21'23"N, 76º12'44"E) E.H. Vishnudas & A.V. Sudhikumar, 10.06.2021.
Description. Female. Body length 1.93-2.04, small spiders. Carapace length 0.58, width 0.64, nearly circular semi transparent. Head is slightly higher than thoracic region. Entire prosoma with a pale yellowish tinge. A triangular vague grey pattern present on the dorsum of the abdomen, tapering towards the fovea. The eyes arranged on a conspicuous elevation. Eight eyes: small anterior median eyes arranged as a dyad: six others arranged as two triads. Diameter of the triad 0.11. The base of the labium marked with a black line ventrally. Clypeus 0.045, pale yellowish in colour. Chelicerae pallid with no protuberance and a pair of black teeth with brown base present. Fangs dark brown with yellowish tinge. Metatarsal trichobothrium varies among individuals. Sternum pale, nearly circular,

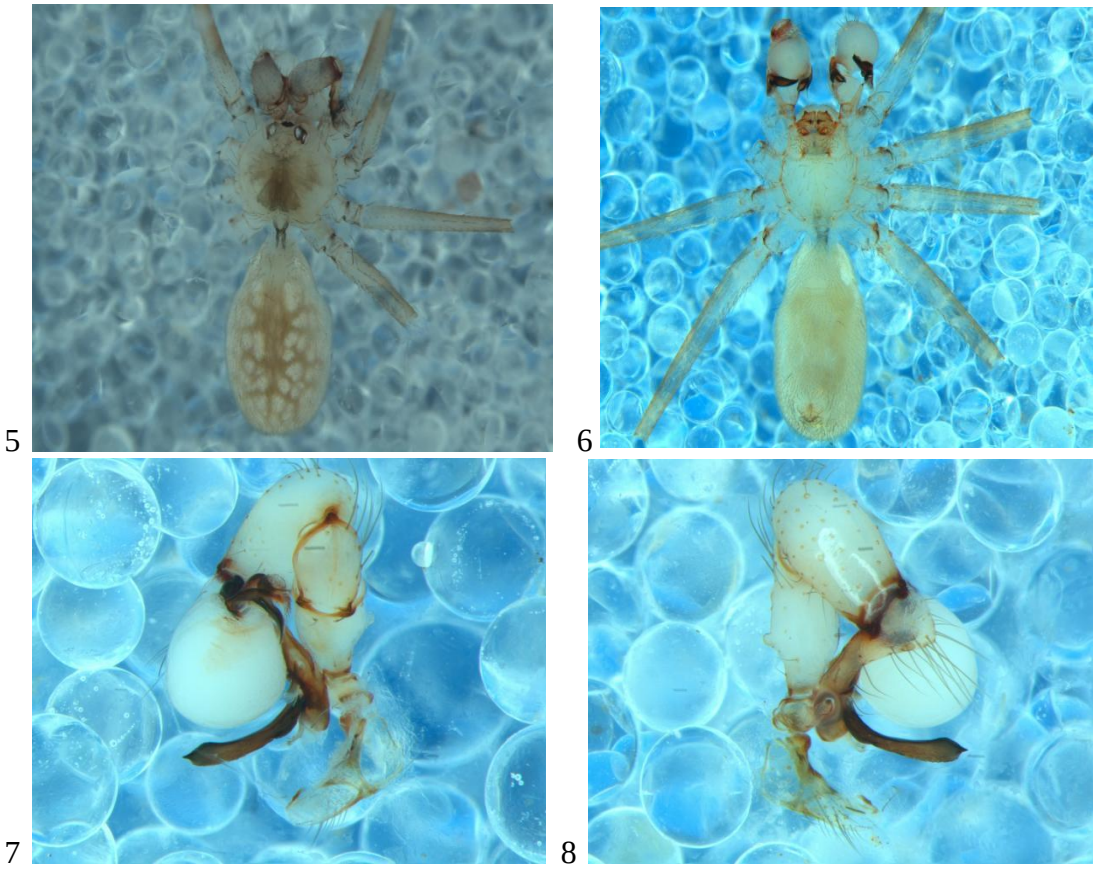
slightly broader than long. Leg I length 13.15 (3.34, 0.16, 3.33, 5.83, 0.49), leg II 8.62 (2.15, 0.31, 2.06, 3.62, 0.48), leg III 5.89 (1.61, 0.22, 1.34, 2.37, 0.35), leg IV 8.73 (2.51, 0.26, 2.08, 3.47, 0.41). Leg formula 1423. Legs of females are smaller comparing to male. Bulbous abdomen, pale grey or reddish brown with a yellow tinge. Irregular and somewhat iridescent blotches on the dorsal side of the abdomen. Height of the abdomen 0.44 towards the pedicel and 0.63 towards the spinnerets (Figs. 1-2). Epigyne placed on a knob like elevation without a sclerotized scape. A dark brown crescent shaped internal structure can be seen distinctly through the cuticle covering of the epigyne. Epigyne has large atrium with anterior saddle shaped sclerites and posteriorly with a pair of oval plates (Figs. 3-4). Three pairs of spinnerets present. A specially arranged group of hairs are present just beneath the posterior spinnerets.



Figs. 1-4. *Micropholcus fauroti* (Simon, 1887) ♀. 1-2. habitus. 1. dorsal view. 2. ventral view. 3-4. epigyne. 3. ventral view. 4. dorsal view.

Male. Total body length 1.60-1.83, somewhat smaller than female. Pale brown small spiders. Prosoma slightly wider than long (length 0.56, width 0.59). Head is slightly elevated from the thoracic region like that in female's prosoma. Unlike in females the demarcation can be clearly seen on the dorsal side of the abdomen which separates the cephalic and thoracic regions. The triangular pattern on the cephalothorax is slightly darker than in female. Eye arrangement and position just like that of female. Anterior median eyes are the smallest, arranged in a straight line. Clypeus 0.047 nearly transparent pale straw coloured. Sternum pale almost round. The base of the labium marked by a dark line like in female and the ends of the line has bright yellow pattern. Chelicerae nearly

transparent pale with yellowish tinge with two pairs of teeth. One pair arranged proximo-frontally and the other stubby and strong teeth arranged as distomesally. Fangs are brown in colour. The tooth has a brown base and black distal end. A pair of rounded protrusion can also be seen on the lateral side (Figs. 5-6). Palp: trochanter with a strong shoe shaped spur. Femur (0.20) longer than broad with a lateral apophysis. Patella 0.19 in length. Tibia prominent 0.34. Procursur simple, dorsally hinged in retrolateral view with a lanceolate ending. Fringed sclerotized nearly cylindrical embolus. The conductor (appendix) has a branched base followed by externally divided heavily sclerotized uncus. Male transfer sperm by inserting the uncus, appendix together with the embolus in to the female genital organ (Figs. 7-8). Leg length: leg I length 16.26 (4.05, 0.22, 4.02, 7.26, 0.71), leg II 10.95 (3.14, 0.17, 2.62, 4.44, 0.58), leg III 6.94 (2.02, 0.19, 1.60, 2.71, 0.42), leg IV 9.94 (3.11, 0.21, 2.35, 3.91, 0.36). Leg formula 1243. Abdomen length 1.04, width 0.63, comparatively smaller than female, pale to brown with a yellowish tinge. Globular abdomen with characteristic irregular, somewhat iridescent pattern on the dorsal side like in female. Ventral side of the abdomen pallid with a yellowish tinge. Specially arranged black hairs can be seen just below the posterior pair of spinnerets.



Figs. 5-8. *Micropholcus fauroti* (Simon, 1887) ♂. 5-6. habitus. 5. dorsal view. 6. ventral view. 7-8. male palp. 7. prolateral view. 8. retrolateral view.

Natural History. Most of the specimens were collected from undisturbed and abandoned ceiling of buildings. They often found near to the web of *Crossopriza lyoni.* They make characteristically fragile, flimsy and irregular webs. Males can mate more than one times, the males tricks and escape from female soon after the mating (Ahmad & Abou-Setta, 2017). Like most of the commonly found pholcids, *M. fauroti* also show parental care. They carry egg sac attached to their body (Deeleman-Reinhold & Prinsen, 1987). Female

lay eggs in the egg basket made with the silk of their own and carry it all throughout the incubation period. Newly hatched spiderlings are transparent and delicate.

Distribution. *M. fauroti* spiders are distributed across the temperate Asia, Southeast Asia, Sri Lanka, Americas, Belgium, Germany, Africa, Australia and Pacific Is. The species is considered as alien but there are no records for any threat made by them to native species (World Spider Catalog, 2021).

Discussion

Our specimens showed significant level of variation in somatic features. A detailed examination of genitalia revealed that they are of the same species. The taxonomic features exclusive for *Micropholcus fauroti* (Simon, 1887) include: prosoma and opisthosoma are connected by an exceptionally slender and long pedicel having a 'V' shaped dark marking dorsally. Both male and female with globose abdomen. Procursurs with prominant globular palpal bulb, dorsally hinged procursur having highly sclerotized embolus and the epigyne is located on an elevation. These characteristic features made clear that the specimen is *M. fauroti*.

Acknowledgments

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A replacement name for *Hypsocephalus* Millidge, 1978 (Araneae: Linyphiidae)

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Abstract

The erigonine genus *Hypsocephalus* Millidge, 1978 is a homonym of the genus *Hypsocephalus* Swift & Ellwood, 1972 (Lutjanidae, Perciformes, Pisces). The replacement name *Staveleya* **nom. nov.** is thus proposed for the preoccupied spider genus nomen.

Keywords: lutjanid, Perciformes, ICZN, preoccupied name, replacement name, erigonine, spiders, taxonomy.

Introduction

Linyphiidae Blackwall, 1859 is the second most speciose family of spiders, with 4717 species currently recognised in 622 genera (World Spider Catalog, 2021). The subfamily Erigoninae Emerton, 1882 is the largest linyphiid subfamily and currently contains upwards of 2600 species, and more than 400 recognised genera (Tanasevitch, 2021) although the exact number of species and genera within this and other subfamilies is still a topic of debate. During ongoing work on the historical nomenclature of spiders, the author noticed that the erigonine genus *Hypsocephalus* Millidge, 1978 is a junior homonym of the lutjanid genus *Hypsocephalus* Swift & Ellwood, 1972.

In this work, in accordance with Article 60 of the International Code of Zoological Nomenclature (ICZN, 2012), a replacement is herein proposed for the preoccupied linyphiid nomen.

Taxonomy

Staveleya **nom. nov.**
Hypsocephalus Millidge, 1978: 119. (preoccupied nomen)

Type species: *Cnephalocotes dahli* Lessert, 1909 (= junior synonym of *Staveleya pusilla* **comb. nov.**)

Remarks: Millidge (1978) described the new linyphiid genus *Hypsocephalus* Millidge, 1978 to house four species which were at that time previously placed in *Mecopisthes* Simon, 1926: *H. huberti* (Millidge, 1975), *H. nesiotes* (Simon, 1915), *H. paulae* (Simon, 1918), and *H. pusillus* (Menge, 1869), all except one being originally described in other genera. *H. huberti* is the exception, having originally been described in *Mecopisthes*. Conversely, *H. nesiotes* and *H. paulae* were both originally described in *Cnephalocotes* Simon, 1884, whereas *H. pusillus* was originally described in *Micronetа* Menge, 1869 as *M. pusilla*. The World Spider Catalog (2021) currently recognises the four aforementioned species to be the known composition of the genus *Hypsocephalus*, and three of the four species: *H. huberti*, *H. nesiotes*, and *H. paulae* have remained unchanged in their taxonomic placements since the publication of Millidge (1978). A detailed chronology of the taxonomic changes relating to the other species, *H. pusillus* (and particularly its junior synonyms *Cnephalocotes dahli* Lessert, 1909 and *Mecopisthes perpusillus* Miller, 1966), can be found in Frick (2008) and Frick & Staręga (2009).

As mentioned before, the author noticed that *Hypsocephalus* Millidge, 1978 is a homonym of *Hypsocephalus* Swift & Ellwood, 1972 (Lutjanidae, Perciformes, Pisces). Swift & Ellwood (1972) described the monotypic *Hypsocephalus* Swift & Ellwood, 1972 to house the extinct *H. atlanticus* Swift & Ellwood, 1972 based on bone and skull fragments found in Eocene limestone in Florida, United States of America. Therefore, as *Hypsocephalus* Swift & Ellwood, 1972 has seniority over *Hypsocephalus* Millidge, 1978 the latter must be replaced. The replacement name *Staveleya* **nom. nov.** is hereby proposed for the preoccupied nomen *Hypsocephalus* Millidge, 1978. The generic epithet is feminine in gender and honours **Eliza Fanny Staveley** (1831–1903) the first woman in Britain to publish a book in the field of arachnology, "*British Spiders: an introduction to the study of the Araneidae of Great Britain and Ireland*" (Staveley, 1866). Consequently, four new combinations are thus established herein: *Staveleya huberti* **comb. nov.**, *Staveleya nesiotes* **comb. nov.**, *Staveleya paulae* **comb. nov.**, and *Staveleya pusilla* **comb. nov.**

Acknowledgments

I thank Marc Milne (University of Indianapolis) and Mike Draney (University of Wisconsin, Green Bay) for insightful discussions on the current numbers of genera and species in linyphiids. I also thank Theo Blick (World Spider Catalog) for providing useful literature.

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Consumption of a hornet by a wasp spider, *Argiope bruennichi* (Araneae: Araneidae)

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Abstract

The wasp spider *Argiope bruennichi* is a generalist predator. However, cases that *A. bruennichi* preyed on hornets (*Vespa* spp.) have been rarely known. On the contrary, the hornet is one of the natural enemies of the wasp spider. In the present study, observation of an unusual case regarding the consumption of a yellow-vented hornet *Vespa analis insularis* by *A. bruennichi* with wrapping is reported. The finding could provide a new insight into the predator-prey relationship between orb-web spiders and hornets.

Keywords: Diet, Hymenoptera, Prey-Predation relation, Vespidae, Web-building spider.

Introduction

The wasp spider *Argiope bruennichi* (Scopoli, 1772) belonging to the family Araneidae is a generalist predator that mostly captures insects with smaller than 4 mm (55%) and more medium-sized (4-10 mm) (28.4%) (Pasquet, 1984). *Argiope bruennichi* is also known as a prey for predacious hornets, the largest eusocial wasps in genus *Vespa* (Hymenoptera: Vespidae). *Vespa* spp. have a strongly negative direct effect on the distribution and abundance of the wasp spider (Bruggisser *et al.*, 2012). From these researches, it could be assumed that the cases of the *A. bruennichi* preys on large-sized hornets, one of the natural enemies of *A. bruennichi*, are not usual. However, such an exact case that *A. bruennichi* consumed a yellow-vented hornet *Vespa analis insularis* Dalla Torre, 1894 distributing from the North area to Tanegashima & Yakushima Islands of Japan (Matsuura, 1988) was observed.

Consequent to the study that a cross spider *Argiope amoena* L. Koch, 1878 fed upon the yellow-vented hornet (Noguchi, 2020), I additionally report herein an observational case of the consumption of *V. analis* by *A. bruennichi*.

Material and Methods

The observation of the consumption was carried out in the Bunkyo Campus at Nagasaki University. The photographs were taken using a Canon digital camera IXY 630 (Tokyo, Japan).

Fig. 1. *Argiope bruennchi* consuming *Vespa analis* in the hub of its web.

Fig. 2. Captured individual item of *Vespa analis*.

Results and Discussion

I observed that an adult female of the wasp spider *A. bruennichi* was consuming a dead adult female of the yellow-vented hornet *V. analis* with wrapping in the centre of the web on azalea (*Rhododendron* sp.) plant at 9:20 am, September 16th, 2021 (Fig. 1). The hunting was not observed directly. In that day, it was windy because the typhoon "Chanthu" was approaching.

After that, I collected the prey item from the web and the body size was measured by a ruler; the length of the body of the hornet was 22.7 mm (Fig. 2; left). In order to identify the vespid, the silk was washed by water (Fig. 2; right).

The body size was rather larger than most of the prey items of *A. bruennichi* reported before (Pasquet, 1984; Szymkowiak *et al.*, 2005). The reason why such an unusual incident occurred is supposed that the wind did not help *V. analis* but *A. bruennichi* to succeed the hunting, almost the same condition as that a cross spider *A. amoena* preyed and fed upon a hornet *V. analis* (Noguchi, 2020).

It has confirmed that the predator-prey relationships between large-sized orb-web argiopids and a yellow-vented hornet could be interchangeable with each other depending on the climate condition again. However, it is not enough to say that the frequency of such inversion that *Argiope* spp. prey the predacious hornets has been revealed yet.

Further observations will contribute to the future study to focus on the factors to influence the flexibility and versatility of the roles as prey and predators of the *Argiope* spp. and the hornets.

Acknowledgment

I would like to appreciate Mr. Hisham K. El-Hennawy (Editor of *Serket*) for his helpful comments on the manuscript.

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Serket (2021) vol. 18(1): 70-72.

The poorly known species *Bassaniodes bufo* (Dufour, 1820) (Araneae: Thomisidae) in Turkey

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Abstract

The male of *Bassaniodes bufo* (Dufour, 1820), collected from Kelkit Valley, is recorded for the first time for Turkish spider fauna. Its habitus and palp are illustrated.

Keywords: Araneae, Thomisidae, *Bassaniodes bufo*, Turkey.

Introduction

Thomisidae, one of the largest spider families in Turkey, are called crab spiders because of their resemblance to crabs. The known crab spider fauna of Turkey includes 91 species and 14 genera. Ground crab spider genus *Xysticus* was described by C.L. Koch, 1835, belonging to the family Thomisidae. Some species of this genus were transferred to *Bassaniodes* Pocock, 1903 by Breitling (2019). The genus *Bassaniodes* is currently containing 38 species and subspecies with their distribution mainly Palaearctic. Among them, 12 species have been recorded in Turkey (Demir & Seyyar, 2017, 2020; World Spider Catalog, 2021).

Bassaniodes bufo (Dufour, 1820) was known from Turkey based only on female specimens (Simon, 1875; Pavesi, 1876). The male of this species has not been found in Turkey until now. In this study, we record male specimens of *Bassaniodes bufo* collected from Kelkit Valley in Anatolia and here illustrated.

Material and Methods

All illustrations were made by a Nikon SMZ-U stereomicroscope with drawing tube. The studied specimens are deposited in the Arachnology Museum of Niğde Ömer

Halisdemir University, Niğde, Turkey (NOHUAM). Identification of the species depended on Bosselaers (2018) and Levy (1985).

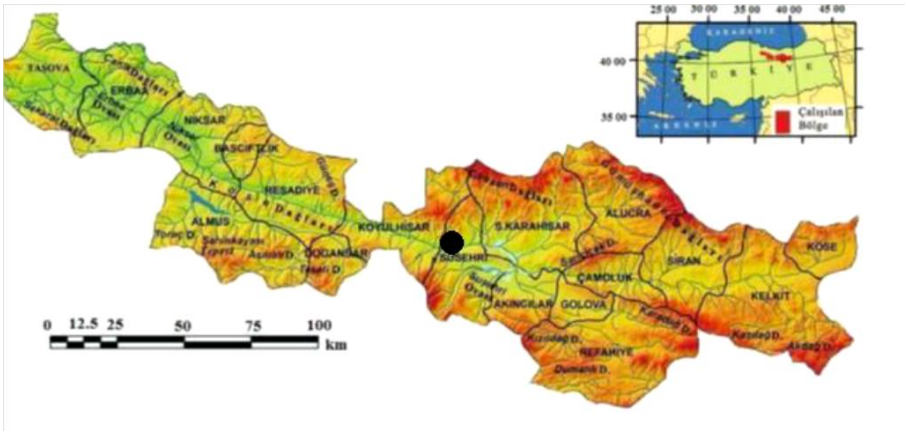

Fig. 1. Locality of male specimens of *Bassaniodes bufo* in Su şehri district in Kelkit Valley.

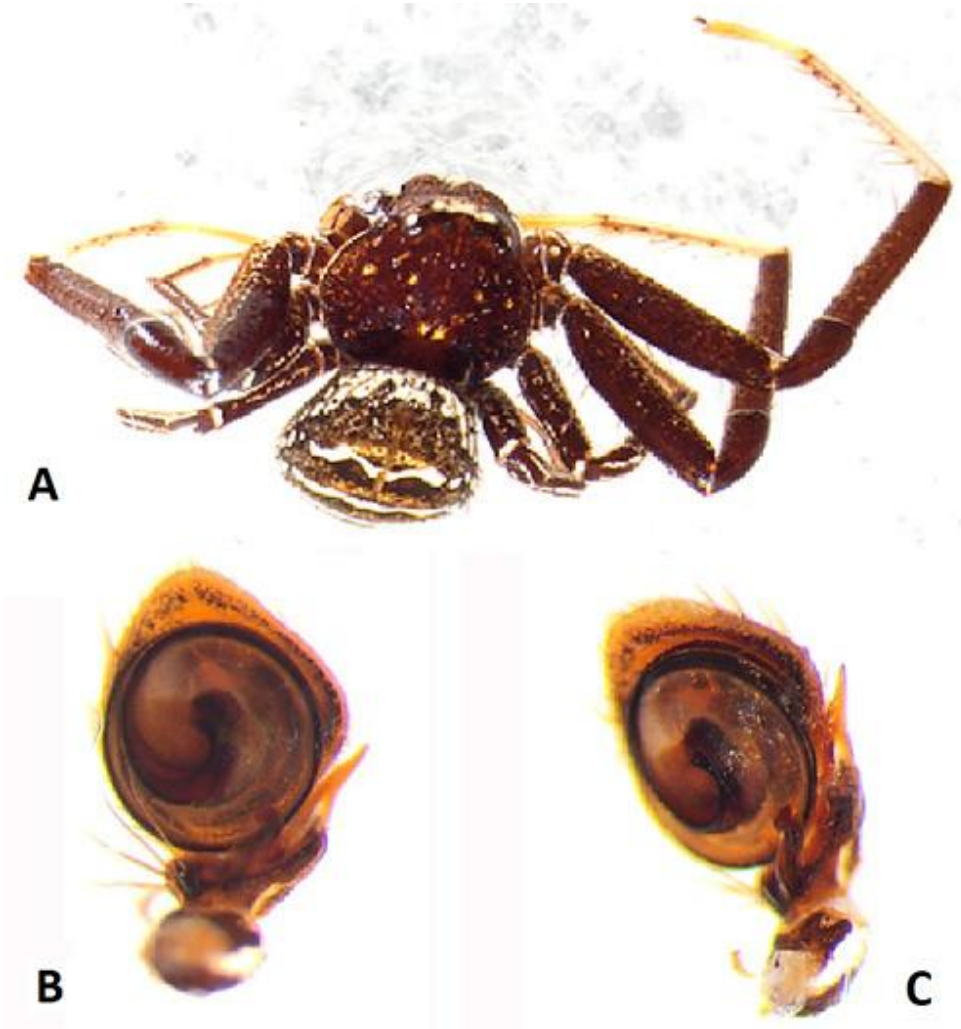

Fig. 2. *Bassaniodes bufo* (Dufour, 1820) ♂. A. habitus, dorsal view. B-C. palp. B. ventral view. C. prolateral view.

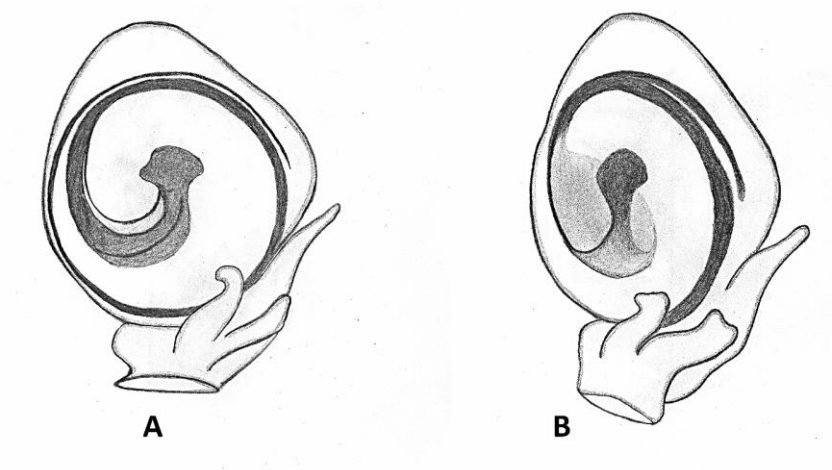

Fig. 3. Male palp of *Bassaniodes bufo* (Dufour, 1820). A. ventral view. B. prolateral view.

Results

Bassaniodes bufo (Dufour, 1820) (Figs. 2-3)
Material Examined. 2♂♂. (NOHUAM), TURKEY: Sivas Province: Suşehri District, Elmaseki village (40°5'8.32"N, 38°5'36.66"E), 1580m, 03.V.2021, leg. H. Demir.
World distribution: Mediterranean (World Spider Catalog, 2021).
Comments: So far, *Bassaniodes bufo* (Dufour, 1820) was recorded from Turkey; Istanbul (Simon, 1875; Pavesi, 1876) province [as *Oxyptila albimana* & *O. bufo*]. We could find these male specimens from Kelkit Valley after a long time in another locality.

Acknowledgments

The authors acknowledge the Scientific and Technological Research Council of Turkey (TÜBİTAK) (Project no: 118Z361). We also thank Research Assistant Züleyha Aslan for her help in drawing of the palp (Fig. 3).

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Genus *Callilepis* Westring, 1874 (Araneae: Gnaphosidae) in Turkey

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Abstract

The gnaphosid spider species, *Callilepis schuszteri* (Herman, 1879) is recorded for the first time from Turkey. Other species of *Callilepis* known from Turkey and this species are illustrated. The collecting data of this species are also given.

Keywords: Spiders, *Callilepis schuszteri*, new record, Turkey.

Introduction

Ground spiders Gnaphosidae is one of the big spider families that contains 2576 worldwide species from 164 genera (World Spider Catalog, 2021). Now, this family is the largest spider family in Turkey containing more than 147 species and 32 genera (Demir & Seyyar, 2017; Danışman *et al.*, 2021). Two species of *Callilepis* are already known from Turkey, *Callilepis cretica* (Roewer, 1928) and *Callilepis nocturna* (Linnaeus, 1758). We have found a third species, *Callilepis schuszteri* (Herman, 1879) as a new record from Turkey. The aim of this paper is to present new data of Turkish *Callilepis*.

Material and Methods

In this study, both male and female specimens of *Callilepis schuszteri* were collected from Sivas Province (Kelkit Valley) in Anatolia. Examined specimens were preserved in 70% ethanol and deposited in the Arachnology Museum of Niğde Ömer Halisdemir University, Niğde, Turkey (NOHUAM). In the identification, Nentwig *et al.*

(2021) was consulted. The identification was made by means of a SZX61 Olympus stereomicroscope.

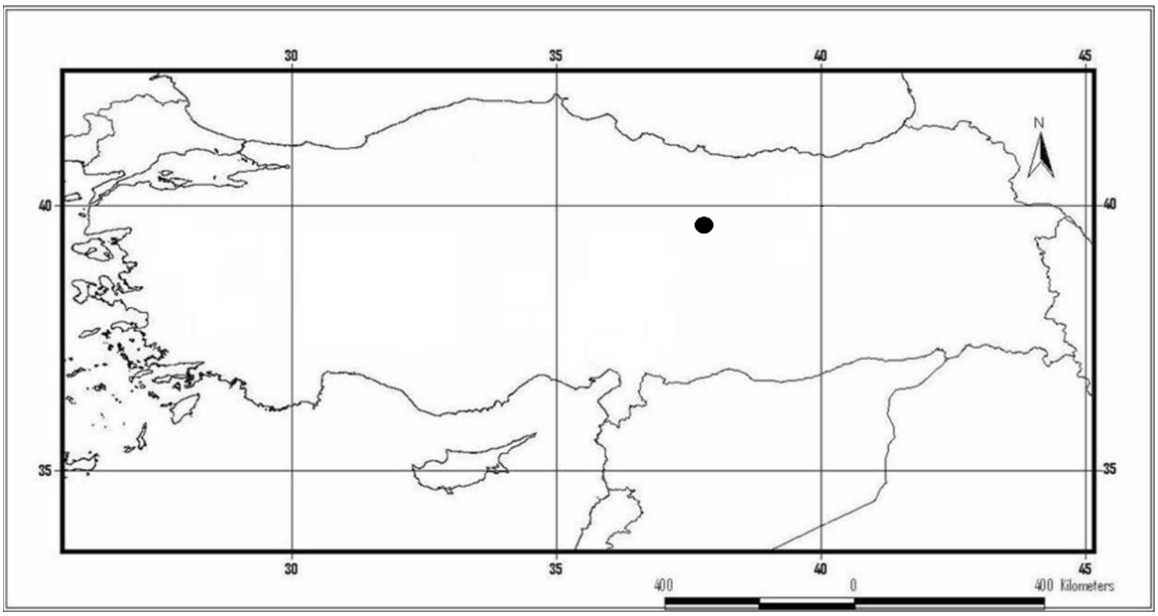

Fig. 1. Locality of *Callilepis schuszteri* (Herman, 1879) in Turkey.

Results

Callilepis schuszteri (Herman, 1879) Figs. 2-3. (New Record)
Collected specimens: 1♂, 2♀♀, Central Anatolia Region: Sivas Province: Zara district, Gelinbeli Pass, 24.VI.2021, leg. Hakan Demir & Osman Seyyar.

Taxonomic references
Gnaphosa schuszteri Herman, 1879: 199, 365, pl. 8, f. 172 (D♂♀).
Pythonissa flavitarsis Simon, 1880b: 120, pl. 3, f. 25 (D♀).
Callilepis schuszteri Chyzer & Kulczyński, 1897: 191, pl. 7, f. 31 (♂♀).
For other references see: World Spider Catalog (2021).

Distribution. Europe, Caucasus, Russia (Europe to Far East), China, Korea, Japan (World Spider Catalog, 2021) and Turkey (New Record).

Comparison of the three *Callilepis* species recorded from Turkey (Figs. 2-3):

- *Callilepis schuszteri* (Herman, 1879) collected from Central Anatolia Region and photographed for this paper (Figs. 2C-3F).

- *Callilepis cretica* (Roewer, 1928) collected from Black Sea Region and photographed for Seyyar (2021) (Figs. 2B-3E).

- *Callilepis nocturna* (Linnaeus, 1758) is recorded from Turkey by Seyyar *et al.* (2009) and Demir & Seyyar (2017) without precise locality. It is collected from Kahramanmaraş and Osmaniye provinces (Seyyar, 2009), Sinop and Ordu provinces (Ergül, 2019), Bolu province (Kartaler, 2017), and Niğde province (Öner, 2014). Also, we collected this species from Kelkit Valley and photographed it for this paper (Figs. 2A-3D).

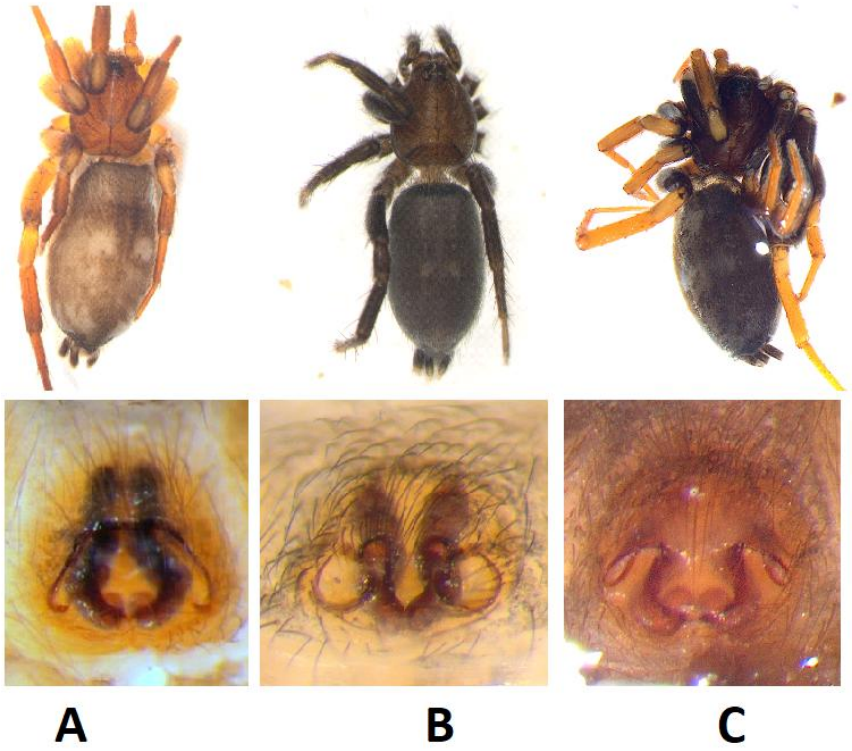

Fig. 2. Female habitus, dorsal view and epigyne, ventral view of Turkish *Callilepis* species. A. *C. nocturna*. B. *C. cretica*. C. *C. schuszteri* (New record).

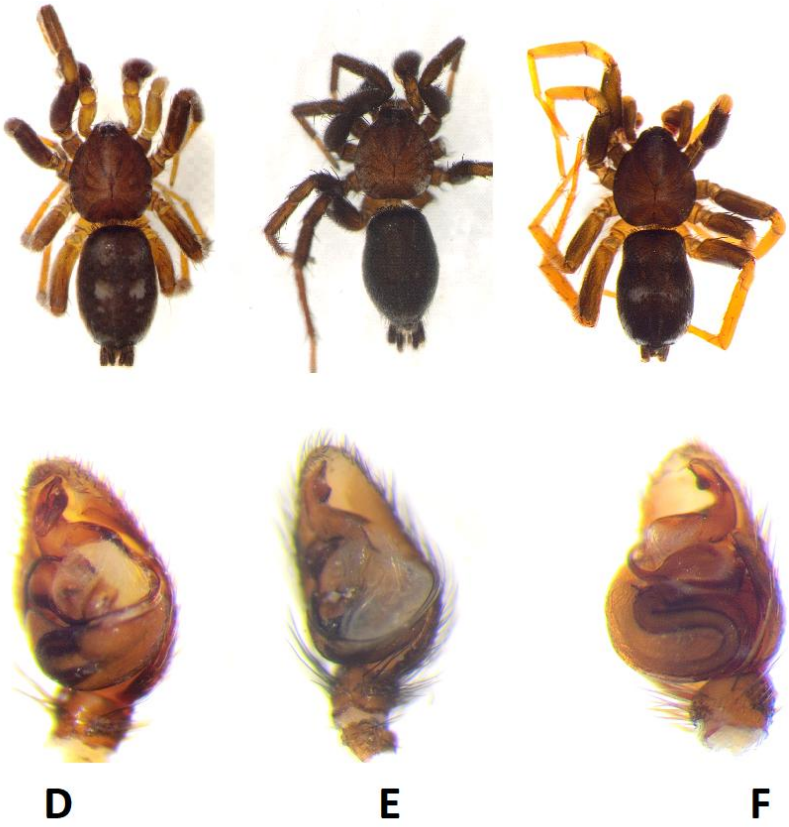

Fig. 3. Male habitus, dorsal view and palp, ventral view of Turkish *Callilepis* species. D. *C. nocturna*. E. *C. cretica*. F. *C. schuszteri* (New record).

Acknowledgments

The authors acknowledge the Scientific and Technological Research Council of Turkey (TÜBİTAK) (Project no: 118Z361).

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The poorly known species *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) in Turkey

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Abstract

Female specimens of *Stegodyphus lineatus* (Latreille, 1817) were collected from Kelkit Valley recording a new locality from Turkey. The habitus and genitalia of this species are illustrated.

Keywords: Spiders, Eresidae, *Stegodyphus lineatus*, new locality, Turkey.

Introduction

Velvet spiders are now among the small spider families in Turkey. The known velvet spider fauna of Turkey includes 4 species and 2 genera (Demir & Seyyar, 2017; Danışman *et al.*, 2021). Three species of them belong to genus *Eresus* [*E. kollari* Rossi, 1846, *E. sandaliatus* (Martini & Goeze, 1778), and *E. walckenaeri* Brullé, 1832], and one species belongs to genus *Stegodyphus* [*S. lineatus* (Latreille, 1817)].

Genus *Stegodyphus* Simon, 1873 is represented by one species in Europe and 20 species all over the World (World Spider Catalog, 2021). So far only one *Stegodyphus* is known in Turkey (Demir & Seyyar, 2017), *Stegodyphus lineatus* (Latreille, 1817). According to literature, this species was recorded from three different localities in Turkey (Kraus & Kraus, 1989; Miller *et al.*, 2012). We collected two female specimens of this species in Kelkit Valley in Anatolia. The aim of this paper is to present new locality record of *Stegodyphus lineatus* with photographs of the Turkish specimens.

Material and Methods

In this study, only two female specimens were collected from Koyulhisar District in Sivas Province (Kelkit Valley) in Turkey (Fig. 1). Examined specimens were preserved in 70% ethanol and deposited in the Arachnology Museum of Niğde Ömer Halisdemir University, Niğde, Turkey (NOHUAM). For the identification, El-Hennawy (2009) was consulted. The identification was made by means of a SZX61 Olympus stereomicroscope.

Fig. 1. Localities of *Stegodyphus lineatus* (Latreille, 1817) in Turkey:
New locality (☆): Koyulhisar district, Sivas Province in Central Anatolia.
Old localities (●): 1. İzmir (Aegean region). 2. Malatya (East Anatolia Region).
3. Gaziantep (Belkıs) (Southeastern Anatolia Region).

Results

Stegodyphus lineatus (Latreille, 1817) (Fig. 2)

Taxonomic references
Eresus lineatus Latreille, 1817
Eresus acanthophilus Dufour, 1820
Eresus unifasciatus C.L. Koch, 1846
Stegodyphus adspersus Simon, 1873
Stegodyphus lineatus Pavesi, 1876
For other references see: World Spider Catalog (2021).

Collected specimens: 2♀♀, Sivas Province: Koyulhisar District, Sugözü village (40°18'58.04"N, 37°39'39.21"E), 650m, 3.V.2021, leg. Osman Seyyar & Hakan Demir.

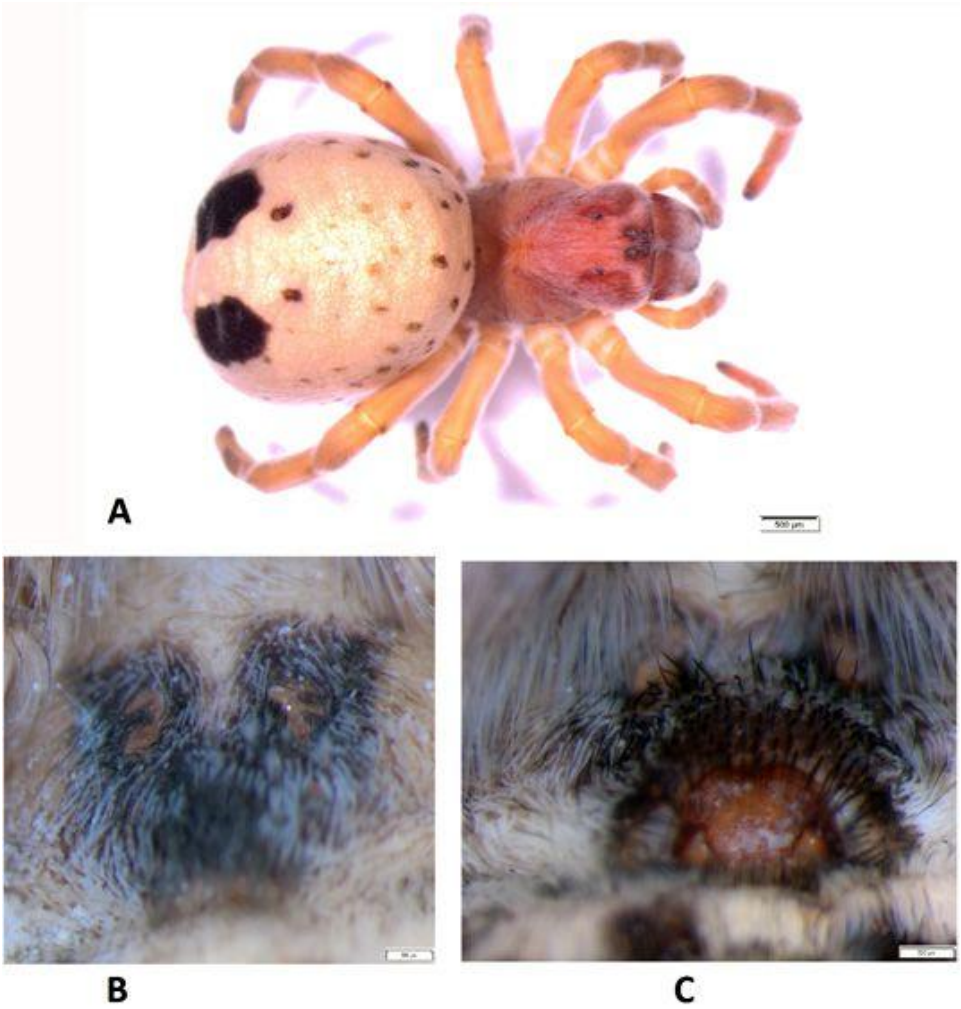

Fig. 2. *Stegodyphus lineatus* (Latreille, 1817) ♀. A. habitus, dorsal view. B-C. Epigyne, ventral view.

Acknowledgments

The authors acknowledge the Scientific and Technological Research Council of Turkey (TÜBİTAK) (Project no: 118Z361).

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First description of the male of the theridiid spider *Meotipa multuma* (Araneae: Theridiidae)

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Abstract

The first description of the male of *Meotipa multuma* Murthappa, Malamel, Prajapati, Sebastian & Venkateshwarlu, 2017 (Theridiidae) and the redescription of the female from Kerala are presented with illustrations.

Keywords: *Meotipa multuma*, Theridiidae, first description, India.

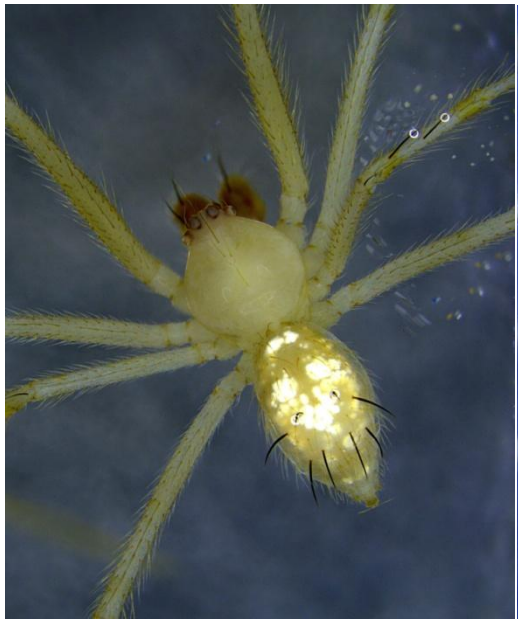
Introduction

Six species of the genus *Meotipa* Simon, 1895 are known from India (World Spider Catalog, 2021). *Meotipa multuma* Murthappa, Malamel, Prajapati, Sebastian & Venkateshwarlu, 2017 was described based on a female specimen collected from Chickamagalur, Karnataka, India. During our survey on comb-footed spiders of Kerala, we found both male and female individuals of *M. multuma*. In this paper we present the first description of the male *M. multuma* along with the redescription of the female *M. multuma* collected from Kerala.

Material and Methods

The specimens were studied using a LEICA SAP0 stereomicroscope. All measurements are in millimetres (mm). Leg measurements are given as: total length, femur, patella, tibia, metatarsus (except palp), and tarsus. The microphotographic images were taken by Leica FLEXACAM C1 digital camera attached to a Leica LEICA SAP0 stereomicroscope with the software package Leica Application Suite X (LAS X). The

specimens are deposited in a reference collection housed at the Division of Arachnology, Department of Zoology, Deva Matha College, Kuravilangadu, Kottayam, Kerala, India (DMCK). Abbreviations: ALE = anterior lateral eye, AME = anterior median eye, MOQ = median ocular quadrangle, PLE = posterior lateral eye, PME = posterior median eye.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Figs. 1-4. *Meotipa multuma* ♂ (DMCK-TH 006b). 1-2. Habitus. 1. dorsal view. 2. ventral view. 3. eyes. 4. palpal organ, prolateral view.

Taxonomy

Family **Theridiidae** Sundevall, 1833
Genus ***Meotipa*** Simon, 1895
Meotipa multuma Murthappa, Malamel, Prajapati, Sebastian & Venkateshwarlu, 2017
(Figs. 1-8)

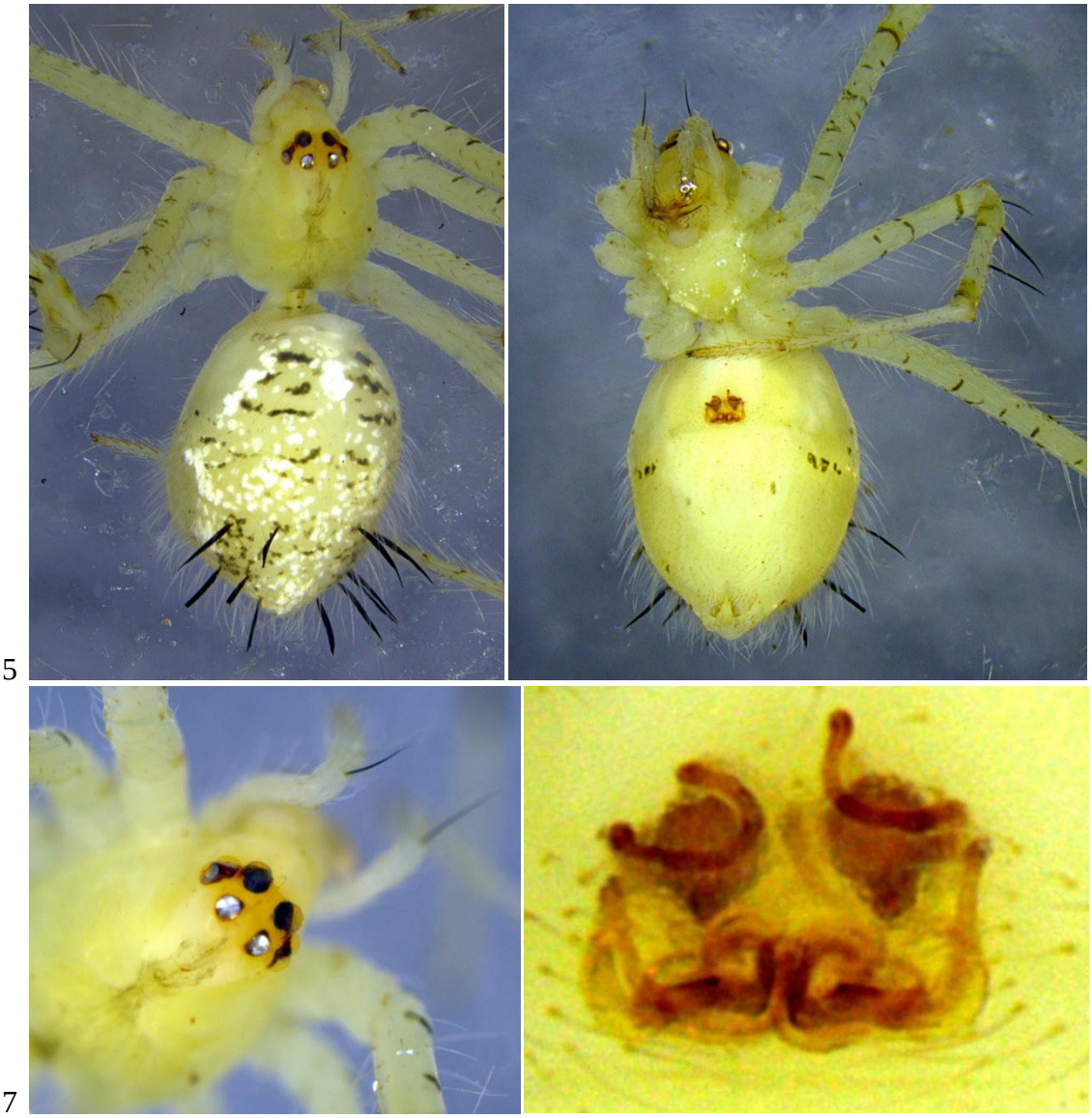
Diagnosis: [In addition to the diagnosis of this species based on a female only by Murthappa *et al.* (2017: 593)] Male of *Meotipa multuma* species is similar to *Meotipa picturata* Simon, 1895 and *Meotipa sahyadri* Kulkarni, Vartak, Deshpande & Halali,

2017, with these species it shares the characteristics such as slender legs with brown intermediate banding, heart-shaped sternum and in the arrangement of eyes and it can be distinguished from these species by the absence of a mid-longitudinal stripe in the carapace; triangular abdomen with green spots (*M. sahyadr*i) and alternate red and black stripe (*M. picturata*) and clearly by the structure of male palp (Deeleman-Reinhold, 2009; Kulkarni *et al.,* 2017; Murthappa *et al.,* 2017).

Description of the male (DMCK-TH 006b; Figs. 1-4) collected from the type locality, by Reshmi Sekhar on 15 March 2021. White in colour. Overall body colour becomes yellowish in preservative. Total length 3.99; carapace length 1.82, width 1.56; abdomen longer than wide with white patterns dorsally, length 2.17, width 1.76, six lanceolate spines at the posterior end; cephalothorax without any patterns with slightly elevated eye region; abdomen almost oval, patterned with white patches; a few yellowish brown hairs present beneath the eye region; eyes arranged in two rows, the posterior row almost straight; eye rims present; PME pearly white with dark brown rims; eye diameters: PME 0.28, AME 0.35, ALE 0.25, PLE 0.27; eye interdistances: PME-PME 0.32, AME-ALE 0.11, AME-AME 0.26, PME-PLE 0.27; MOQ: length 0.38, width 0.41; sternum longer than wide, heart-shaped, and covered in fine yellowish brown hair with thickened borders; legs short, slender, white in colour with intermediate light brown banding, clothed with fine spines; tibia with yellowish brown bands and 2 or 3 spines. Measurements of legs: I 7.36 (2.16, 0.65, 1.62, 1.97, 0.96), II 5.57 (1.80, 0.33, 1.33, 1.56, 0.55), III 4.76 (1.61, 0.25, 1.20, 1.36, 0.34), IV 6.48 (2.02, 0.43, 1.47, 1.78, 0.78); ventral region without any patterns. Leg formula: 1423. Abdomen almost oval, patterned with white patches, six lanceolate spines at the posterior end. The palp yellowish brown, cymbium oval, covered in setae, cymbial hook slightly tapering. Embolus long and narrow with broad tip facing semicircular conductor (Fig. 4).

Redescription of the female (DMCK-TH 006; GenBank: MW829344; Figs. 5-8) collected from type locality, by Reshmi Sekhar on 15 March 2021.The colour white with black and white patterns in the abdomen. Fovea extended. Preservation causes the colour to fade more. Total length 5; carapace length 2.12, width 1.76; abdomen length 2.87, width 2.23. Cephalothorax longer than wide, patterns absent. Ocular region slightly elevated. A few fine black hairs in the posterior region of the eyes. Eyes arranged in two rows and heterogeneous, PME white, surrounded by light brown eye rims. AME, PME, PLE similar in size. Distance between eyes: PME-PME 0.39, AME-ALE 0.14, AME-AME 0.30, PME-PLE 0.32, ALE and PLE closely placed. MOQ length 0.43, width, 0.45. Labium scopulated, chelicerae without teeth. Sternum longer than wide, heart shaped, covered with fine hair, transparent white in shade. Legs long and slender, clothed with fine spines. Tibia with yellowish brown bands and 2-4 lanceolate spines dorsally. A small dark banding seen at the junction of the tarsus and metatarsus as well as the metatarsus and tibia of the first leg. Measurements of palp and legs: Palp 1.15 (0.36, 0.17, 0.34, 0.28); Leg I 10.86 (3.54, 0.73, 2.38, 3.13, 1.08), II 5.12 (1.36, 0.75, 0.94, 1.28, 0.79), III 3.21 (0.92, 0.27, 0.83, 0.75, 0.44), IV 10.13 (3.03, 0.81, 2.48, 2.85, 0.96). Leg formula: 1423. Abdomen longer than wide, and the dorsal area covered by light yellow and off-white patterns with a few black drawings interspersed; covered with fine hair; 11 lanceolate spines at the posterior end of the abdomen. Very few black drawings seen on the lateral sides. The ventral side light yellowish. Epigyne with round spermathecae, copulatory duct with lateral origin, long and twisted around spermathecae (Figs. 6,8). Fertilisation duct twisted, slightly pointed at the end (Murthappa *et al.*, 2017).

Habitat: male and female individuals were collected from the bottom of a leaf.



Figs. 5-8. *Meotipa multuma* ♀ (DMCK-TH 006). 5-6. Habitus. 5. dorsal view. 6. ventral view. 7. eyes. 8. epigyne, ventral view.

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Redescription of *Tetragnatha cochinensis* (Araneae: Tetragnathidae) after a century in India

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Abstract

Tetragnatha cochinensis was first described by Gravely from India in 1921. *T. cochinensis* is distinguished from other tetragnathids by the unique arrangement of cheliceral teeth. The structure of chelicerae were briefly described and illustrated, but the genitalic descriptions of both sexes were inadequate. This paper provides detailed description of *T. cochinensis* with photographs on the basis of newly collected specimens from Kerala, India.

Keywords: Araneae, Long-jawed spiders, redescription, *Tetragnatha*, India.

Introduction

Tetragnathidae or long-jawed spiders include 50 genera with 982 species (World Spider Catalog, 2021). The family is a cosmopolitan spider clade most of which typically build horizontal orb webs with open hubs. They are found in all continents except Antarctica (Alvarez-Padilla *et al.*, 2020). They have highest diversity in humid tropical and subtropical areas of the world. They build orb webs near rivers, streams and hiding in nearby vegetation (Dimitrov & Hormiga, 2011). Among tetragnathids, *Tetragnatha* Latreille, 1804 is the largest genus currently comprises 323 species and subspecies (World Spider Catalog, 2021). Indian tetragnathids constitute 55 species belong to 12 genera and among these genus *Tetragnatha* constitutes 25 species (Caleb & Sankaran, 2021). Members of this genus are elongate, moisture loving, nocturnal and most abundant

during rainy season. They may be distinguished by the structure of chelicerae (Gravely, 1921). They are characterized by the loss of median apophysis, the conductor wrapping and coiling with the embolus, presence of dorsal femoral trichobothria, globular tegulam, enlarged sperm duct and spermatheca opens directly into a membraneous chamber (Alvarez-Padilla, 2007). In tetragnathids, many species are poorly described at the taxonomic level, species redescriptions and local revisions are frequent, but the complete revisions of the genus are unavailable (Castanheira *et al.*, 2019).

Material and Methods

Specimens were collected by visual searching and hand picking from the surface of leaves and stems near water bodies. The collected specimens were stored in 70% ethyl alcohol. Specimens were examined under Leica M205C stereomicroscope. Digital images were taken by means of Leica DMC4500 digital camera attached to Leica M205 C stereomicroscope, with the software package Leica Application Suite (LAS), version 4.3.0. LAS montage facility. All measurements were taken in mm. Measurement data for palps and legs are as follows: total length (femur, patella, tibia, metatarsus [except palp], and tarsus). Specimens were deposited in the reference collection at the Centre for Animal Taxonomy and Ecology (CATE), Department of Zoology, Christ College (Autonomous), Irinjalakuda, Kerala, India.

Abbreviations used in the text and figures are as follows (Castanheira *et al.*, 2019): a = male dorsal apophysis used to lock females fang during copulation, AX1 = auxiliary guide tooth of the lower row, AXu = auxiliary guide tooth of the upper row above Gu, BC = basal cusp on the female's cheliceral fang, C = conductor, E = embolus, Gl = guide tooth of the lower (or ventral) row, Gu = guide tooth of the upper (or dorsal) row, L = tanslucent lobe at the mesal side of paracymbium, L2-n =teeth on the lower row numbered from the distal end after G1, P = paracymbium, rsu = remaining proximal teeth on the upper row after T in males, t = a tooth or prominence found in males of some species, T = elongated tooth in the upper row of some males, U2-n = teeth on the upper row numbered from the distal end after Gu.

Taxonomy

Family **Tetragnathidae** Menge, 1866
Genus ***Tetragnatha*** Latreille, 1804
Tetragnatha cochinensis Gravely, 1921

Diagnosis: A long and slender species. Carapace is elongated and much narrowed anteriorly. Abdomen long and cylindrical with evident black spots on the dorsum of the female. Two rows of eyes are somewhat strongly recurved. Anterior laterals are small and are near to the posterior laterals. Male chelicerae are longer than in female. Female fang is much more geniculate and swollen at the middle (Gravely, 1921). Male palp characterized by elongated cymbium and short paracymbium. Genital fold is long and located on the anterior of the abdomen.

Material examined. 3♂♂, 4♀♀ Athirappilly, Kerala, India (10.2851°N, 76.5698°E). Anju K. Baby & A.V. Sudhikumar, 11.08.2021.

Description. Male (Fig. 1). Total body length 4.40. Carapace length 1.24 and width 0.58. Carapace yellow, elongated, much narrower anteriorly and with two darker thin parallel lines from the cephalic furrow, passing through the fovea, reaching the posterior region (Figs. 1A-C). Anterior lateral eyes are smaller and are near to posterior laterals. Sternum

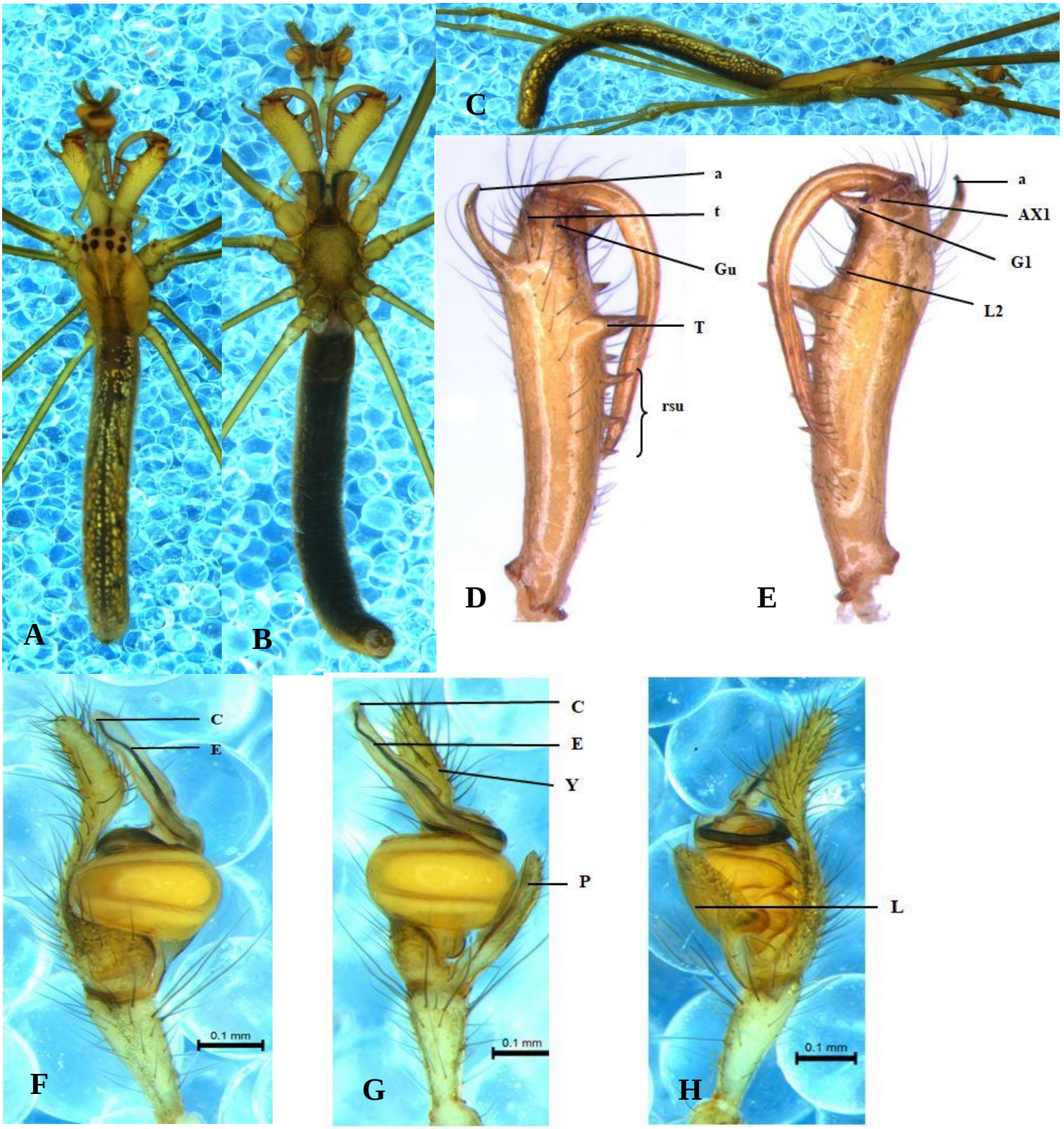

Fig. 1. *Tetragnatha cochinensis* Gravely, 1921 ♂. A. dorsal habitus. B. ventral habitus. C. lateral habitus. D-E. left chelicera. D. dorsal view. E. ventral view. F-H. left palp. F. dorsal view. G. mesal view. H. ventral view.

light yellow with darker contour, Labium elongated, Clypeus 0.09 and pale yellow in colour. Leg I length 14.22 (3.89, 0.41, 4.58, 4.30, 1.04), leg II 7.80 (2.51, 0.38, 2.10, 2.22, 0.59), leg III 3.57 (1.27, 0.22, 0.77, 1.10, 0.21), leg IV 8.23 (2.92, 0.27, 2.32, 2.16, 0.56). Leg formula 1423. Abdomen length 3.16 and width 0.38. Abdomen is slender, cylindrical and yellow coloured with guanine spots. Black spots present in the dorsum of the abdomen are not much clear, but with an obvious black spot on the postero-dorsal

region of the abdomen. Abdominal venter much darker than in female. Fang without any projections. Chelicerae 1.08 long, 0.30 wide and light yellow in colour. 'a' is very slender distally with truncate apex, directed upward and outward. 't' larger than Gu and directed upward. Gu small and a large gap between Gu and T. 'T' with larger base, elongated and pointed. AXu absent. 'rsu' with four teeth evenly spaced and arranged in descending series (Fig. 1D). AX1 and G1 are present in the fang base. AX1 small and both sharing same basis. G1 large and slightly projected upward. AX1 much closer to fang base than Gu. L2 is much smaller than G1 followed by four teeth (Fig. 1E). Palp total length 1.59 (0.64, 0.22, 0.22, 0.51). Palp with very elongated cymbium and strongly developed. Conductor almost transparent, tapering towards the apex and not twisted at the distal halves with embolus. Embolus thickened proximally and relatively narrows at the distal end. Embolus originating at the middle portion of the bulb, with a long curve at the initial portion. Paracymbium is short, thick and a knob present at the ectal side. L is wider (Figs. 1F-H).

Female (Fig. 2). Body length 6.45. Carapace, eyes and sternum same as male. Carapace 1.24 long and 0.75 wide (Figs. 2A-C). Labium elongated and dark brown in colour. Clypeus 0.08 and yellow in colour. Legs are slender and pale yellow in colour. Leg I length 16.68 (5.08, 0.49, 5.48, 4.78, 0.85), leg II 9.42 (2.97, 0.39, 2.85, 2.68, 0.53), leg III 4.44 (1.60, 0.26, 0.94, 1.18, 0.46), leg IV 10.23 (3.33, 0.37, 3.08, 2.88, 0.57). Leg formula 1423. Abdomen length 5.21 and width 0.46. Abdomen with guanine spots along with dark spots on the dorsal side. A noticeable black spot is present on the postero-dorsal region of the abdomen. Abdominal venter is dark without any markings. Chelicerae 0.96 long, 0.22 wide, yellow coloured and comparatively shorter than in males. Fang is closer to both rows of teeth and tapering to the tip. Cheliceral promargin bears eight teeth. AXu absent, Gu directed upward and not much closer to the fang. U2 slightly larger than Gu, pointed and well separated. U2 is opposite the fifth ventral. Size of the remaining teeth is decreasing (Fig. 2D). G1 near to the fang base and AX1 absent. L2 pointed upward and remaining nine teeth are decreasing in size. L2 and L3 are larger than G1 (Fig. 1E). Comparatively a large round prominence found in the lower side of the retromargin. BC dark, small and present at the middle of the fang. Genital fold long, laterally compressed, with thick and straight tip (Fig. 2F).

Natural History. *T. cochinensis* spiders build their orb webs near river, streams or water logging areas. They usually build large orb webs horizontally to different water bodies. They are nocturnal and sometimes hiding in nearby vegetation under leaves, when direct sunlight is quite difficult.

Distribution. India (endemic species).

Discussion

Gravely (1921) described *T. cochinensis* on the basis of cheliceral morphology of male and female collected from Southern regions of India. But the description lacks genital structures and other morphological characters. The female is identical in cheliceral morphology to the newly collected female from Athirappilly, Kerala, India. The description and illustration of chelicerae perfectly matches to the photographs of the newly collected specimen with geniculate fang, small teeth, first teeth of each row close to the fang base, second teeth of both rows situated far behind and second dorsal is opposite the fifth or sixth ventral. Detailed examinations of male shows, chelicerae are

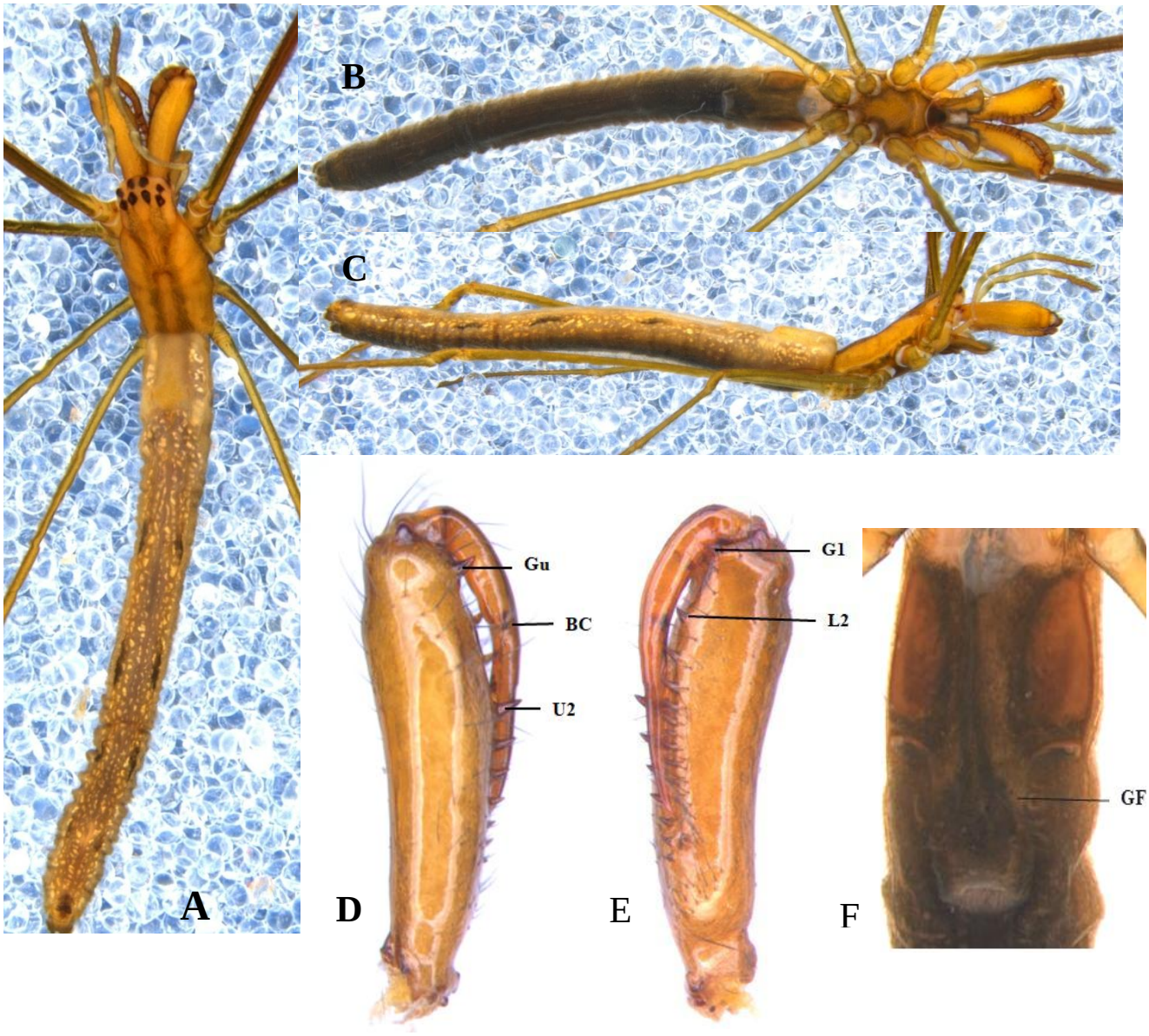

Fig. 2. *Tetragnatha cochinensis* Gravely, 1921 ♀. A. dorsal habitus. B. ventral habitus. C. lateral habitus. D-E. left chelicera. D. dorsal view. E. ventral view. F. epigynal fold, ventral view.

longer than in female and cheliceral apophysis is slender with truncate apex. First dorsal tooth is slightly larger than first ventral, which is minute. The position of second tooth of each row is somewhat different in the original illustrations. The second ventral tooth is anterior to the second dorsal tooth, but much closer to first ventral tooth. The second tooth of both rows is large and remaining teeth are decreasing in size.

Acknowledgments

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An updated checklist of spiders (Arachnida: Araneae) in Northeast India

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Abstract

An updated checklist of faunal biodiversity of the spiders in all eight states of northeast India is presented herewith. A total of 956 species of spiders described under 225 genera belonging to 43 families were recorded in all eight states of northeast India. The biodiversity of spiders is maximum in Assam (266 species, 136 genera, 27 families) followed by Meghalaya (225 species, 119 genera, 29 families), Manipur (142 species, 88 genera, 25 families), Arunachal Pradesh (108 species, 56 genera, 20 families), Sikkim (89 species, 55 genera, 21 families), Tripura (79 species, 53 genera, 16 families), Mizoram (70 species, 48 genera, 18 families), and Nagaland (7 species, 6 genera, 5 families). However, most of the areas in all states are still virgin regarding the faunal survey programmes and need intensive and extensive survey in those areas by enthusiastic workers.

Keywords: Spiders, Araneae, checklist, faunal distribution, Northeast India.

Introduction

Spiders are chelicerate arthropods belonging to the order Araneae (Class Arachnida) and are highly diverse and abundant in the terrestrial ecosystem. They are predators and lavishly feed on insects and are one of the natural agents controlling insect pests in agricultural and horticultural ecosystems. The order Araneae ranks seventh in global diversity (49,711 species, 4232 genera, 129 families; World Spider Catalog, 2021) after the five largest insect orders (Coleoptera – ca. 400,000 species, Lepidoptera – ca. 180,000 species, Hymenoptera – ca. 150,000 species, Diptera – ca. 125,000 species,

Hemiptera – ca. 50,000 species) and one arachnid order, Acari – over 50,000 species, in terms of species diversity (Sharma *et al.*, 2020a). Out of them, only 1870 species belonging to 476 genera in 61 families are reported in India (Caleb & Sankaran, 2021), though in recent updates, 2344 species under 596 genera grouped into 65 families are recorded in India (Singh & Singh, 2021a). In this list, several species were considered cases of misidentification by the authors. However, there are many species in the wild and museums that still await description and classification. Despite recent research works on the diversity and distribution of spiders in India, their number is insufficient as compared to the other parts of the world.

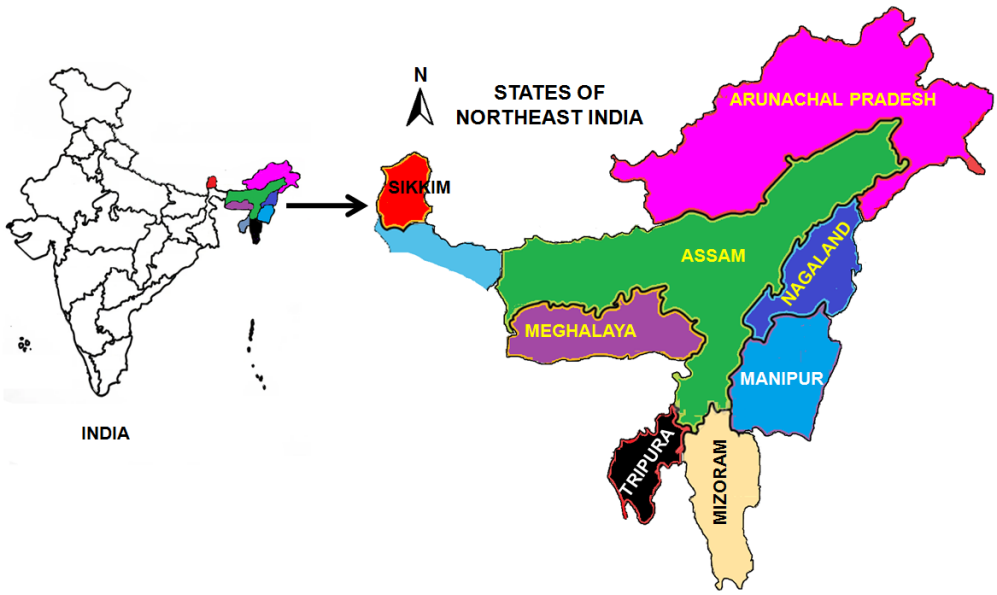

Fig. 1. Map showing northeast states of India.

Northeast India comprises 8 states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura (Fig. 1). The region shares an international border such as Tibet Autonomous Region and China in the north, Myanmar in the east, Bangladesh in the south-west, Nepal in the west, and Bhutan in the north-west and comprises an area of 262,230 km^2. The Northeast region is categorised into the Eastern Himalaya, the Patkai and the Brahmaputra and the Barak vallley plains. It has a primarily humid subtropical climate with hot, humid summers, severe monsoons, and mild winters and has some of the Indian subcontinent's last remaining rainforests supporting diverse flora and fauna and several crop species. The region has Brahmaputra-Barak river systems and their tributaries. The two-thirds of the area is hilly terrain interspersed with valleys and plains; the altitude varies from almost sea level to over 7,000 m above sea level. The region receives high rainfall, averaging around 1,000 cm. Arunachal Pradesh and Sikkim both have a montane ecology with cold, snowy winters and mild summers (Dikshit & Dikshit, 2014). The present article provides an updated checklist of the fauna of spiders in different states of northeast India.

Material and Methods

The present checklist is based on the published literature on the spiders from India in recent past books, book chapters, journals, proceedings, records of Zoological Survey of India, Kolkata, few authentic theses, websites, and World Species Catalog (2021) up to

October 18, 2021. In most of the literature published earlier, there were several errors in the scientific names of the spiders even in the recent publications. The researches on spider taxonomy like other taxa are continued with the description of new taxa, their modified status, and the publication of other nomenclatural decisions and clarifications (World Spider Catalog, 2021; Singh & Singh, 2020). In the present checklist, attempts have been made to correct the errors in the scientific names of the spiders following World Spider Catalog (2021). If a spider species is identified only up to a generic level, it was considered as species if no other species of that genus is reported within that state. In few cases, the locations of spider species are corrected, particularly of those spiders that were described/recorded during the British period and even after the independence of India (1947) till the formation of five northeast states that were carved from a single state Assam in different years, e.g. Manipur and Tripura (in 1956 as union territories and 1972 as states), Nagaland (in 1963 as state), Meghalaya (in 1970 as union territory and 1972 as state), and Mizoram (in 1972 as union territory and 1987 as state). For synonymy and endemism, following references may be looked at for 42 families of spiders recorded in 8 states of northeast India, such as Agelenidae (Singh *et al.*, 2021), Amaurobiidae (Singh *et al.*, 2021), Araneidae (Singh & Singh, 2021a), Bemmeridae (Singh & Singh, 2020), Cheiracanthiidae (Singh *et al.*, 2020a), Clubionidae (Singh BB *et al.*, 2020), Corinnidae (Singh *et al.*, 2021), Ctenidae (Singh BB *et al.*, 2020), Deinopidae (Singh BB *et al.*, 2020), Dictynidae (Sharma *et al.*, 2021), Gnaphosidae (Singh & Singh, 2021b), Hahniidae (Singh *et al.*, 2020b), Halonoproctidae (Singh & Singh, 2020), Hersiliidae (Singh *et al.*, 2020b), Idiopidae (Singh & Singh, 2020), Ischnothelidae (Singh & Singh, 2020), Linyphiidae (Sharma *et al.*, 2020a), Liocranidae (Sharma *et al.*, 2020b), Lycosidae (Singh, 2021a), Macrothelidae (Singh & Singh, 2020), Nemesiidae (Singh & Singh, 2020), Oecobiidae (Sharma *et al.*, 2020b), Oonopidae (Tiwari *et al.*, 2021a), Oxyopidae (Singh, 2021b), Philodromidae (Singh & Singh, 2021c), Pholcidae (Tiwari *et al.*, 2021b), Pimoidae (Tiwari *et al.*, 2021c), Pisauridae (Tiwari & Singh , 2021), Psechridae (Tiwari *et al.*, 2021c), Salticidae (Singh *et al.*, 2020c,d,e,f), Scytodidae (Singh BB *et al.*, 2021), Selenopidae (Tiwari *et al.*, 2021c), Sicariidae (Tiwari *et al.*, 2021c), Sparassidae (Singh, 2021c), Tetrablemmidae (Tiwari *et al.*, 2021c), Tetragnathidae (Singh, 2021d), Theraphosidae (Singh & Singh, 2020), Theridiidae (Singh, 2021e), Theridiosomatidae (Tiwari *et al.*, 2021c), Thomisidae (Singh & Singh, 2021d), Uloboridae (Singh & Singh, 2021e), and Zodariidae (Singh & Singh, 2021e).

Results and Discussion

A total of 956 species of spiders described under 225 genera belonging to 43 families were recorded in all eight states of northeast India. The biodiversity of spiders is maximum in Assam (266 species, 136 genera, 27 families) followed by Meghalaya (225 species, 119 genera, 29 families), Manipur (142 species, 88 genera, 25 families), Arunachal Pradesh (108 species, 56 genera, 20 families), Sikkim (89 species, 55 genera, 21 families), Tripura (79 species, 53 genera, 16 families), Mizoram (70 species, 48 genera, 18 families), and Nagaland (7 species, 6 genera, 5 families). However, most of the areas in all states are still virgin regarding the faunal survey programmes and need intensive and extensive survey in those areas by enthusiastic workers.

Following is the list of spiders recorded/described from the northeast states of India.

A. Arunachal Pradesh

Arunachal Pradesh, one of the northeastern-most state in India, is situated between 26.28º and 29.30ºN latitudes and 91.20º and 97.30ºE longitudes covering an area of 83,743 km^2. Biogeographically, it is the richest eastern state in Himalayan zone. The entire state forms a complex hill system with varying elevations ranging from 50 m in the foot-hills and gradually ascending to about 7000 m, traversed throughout by a number of rivers and rivulets with 100 cm to 575 cm, annual rainfall over 8-9 months mostly during May to October. This topography and climate favour the growth of lush forests having very rich flora and fauna making it a natural wonderland. There are two national parks and nine wildlife sanctuaries in the state managed by the forest department. There are 25 administrative districts in Arunachal Pradesh (Fig. 2).

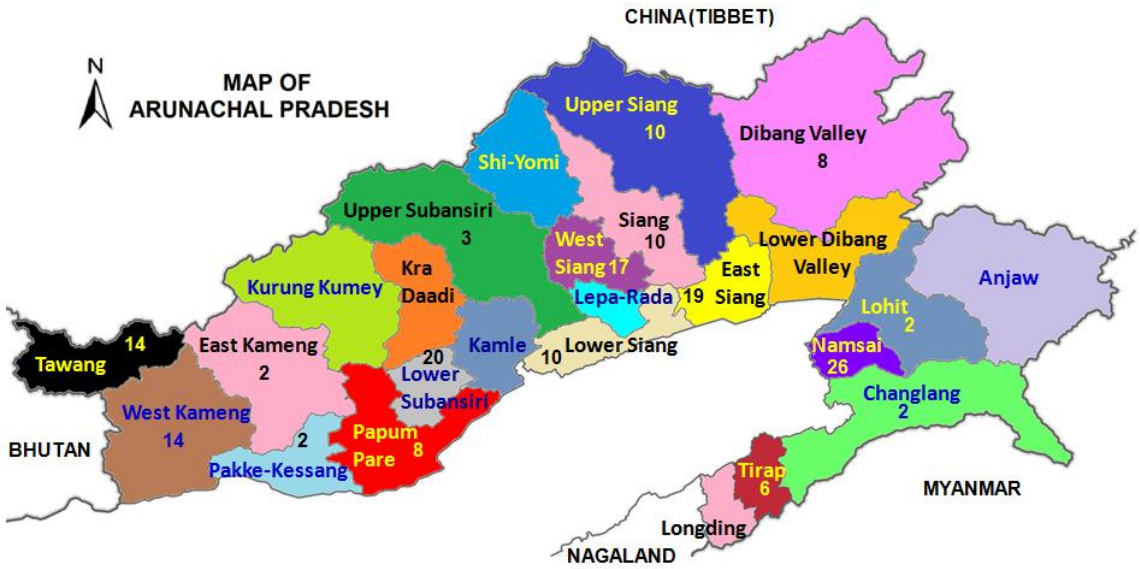

Fig. 2. Number of species of spiders described/recorded from different districts of Arunachal Pradesh.

In Arunachal Pradesh, Gravely (1931) was probably the first who had reported the occurrence of *Heteropoda leprosa* Simon, 1884 from Dafla Hills. Among the Indian authors during post independent period, Tikader (1963) was the first to describe a species of Araneidae, *Cyrtarachne schmidi* from West Kameng district of Arunachal Pradesh. Later on, Tikader (1971), Tikader & Malhotra (1980, 1981), Gajbe (1988, 1999), Jäger (2001), and Bastawade (2002) described/recorded few more species from Arunachal Pradesh. Biswas & Biswas (2006) were the first who accounted 58 species of spiders under 31 genera. Later, Caleb & Kumar (2018) catalogued 67 species under 35 genera from Arunachal Pradesh, Chetry & Moran (2019) recorded 24 species under 20 genera from Namsai district, and Pathak *et al.* (2020) listed 13 species under 7 genera from rice field of Siang belt. Most of the national parks and sanctuaries, forest areas, agricultural fields of the states still await intensive and extensive survey programmes to record these predatory creatures.

In the present compilation, a total of 108 species described under 56 genera belonging to 20 families were enlisted that have been recorded/described from Arunachal Pradesh giving up-to-date information in the light of modern taxonomic concept. Type locality of *Pseudopoda abnormis* Jäger, 2001 was shown in Mishmi Hills, 28.00ºN 96.25ºE, Assam by Jäger (2001), but the place is located in Arunachal Pradesh. Out of 25 districts of Arunachal Pradesh, most of the spiders were recorded from Siang belt (26

species, all 5 districts together), Namsai (26 species), Lower Subansiri (20 species), Tawang and West Kameng (14 species each) districts. No spider was so far collected from 8 districts of Arunachal Pradesh (Anjaw, Kamle, Kra Daadi, Kurung Kumey, Lepa-Rada, Longding, Lower Dibang Valley, Shi-Yomi) (Fig. 2). Also, none of the species was widely distributed in Arunachal Pradesh. Most of the species of spiders are distributed less than 6 districts. Hence, intensive and extensive faunal survey is required in these areas. Following is the list of species of spiders recorded/described from different districts of Arunachal Pradesh.

1. Araneidae

- *Araneus mitificus* (Simon, 1886) (Sen *et al.*, 2015; Chetry & Moran, 2019)
- *Argiope catenulata* (Doleschall, 1859) (Pathak *et al.*, 2020)
- *Argiope minuta* Karsch, 1879 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Argiope pulchella* Thorell, 1881 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Cyclosa bifida* (Doleschall, 1859) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Cyclosa mulmeinensis* (Thorell, 1887) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Cyclosa spirifera* Simon, 1889 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Cyrtarachne schmidi* Tikader, 1963 (Tikader, 1963, 1982; Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Eriophora* sp. (Chetry & Moran, 2019)
- *Eriovixia excelsa* (Simon, 1889) (Saha *et al.*, 2016)
- *Gasteracantha diadesmia* Thorell, 1887 (Chetry & Moran, 2019)
- *Gasteracantha kuhli* C.L. Koch, 1837 (Chetry & Moran, 2019)
- *Gasteracantha unguifera* Simon, 1889 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Herennia multipuncta* (Doleschall, 1859) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Neoscona bomdilaensis* Biswas & Biswas, 2006 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Neoscona mukerjei* Tikader, 1980 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Neoscona nautica* (L. Koch, 1875) (Chetry & Moran, 2019)
- *Nephila dirangensis* Biswas & Biswas, 2006 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Nephila pilipes* (Fabricius, 1793) (Biswas & Biswas, 2006; Caleb & Kumar, 2018; Chetry & Moran, 2019)
- *Parawixia* sp. (Chetry & Moran, 2019)

2. Cheiracanthiidae

- *Cheiracanthium triviale* (Thorell, 1895) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

3. Clubionidae

- *Clubiona japonicola* Bösenberg & Strand, 1906 (Pathak *et al.*, 2020)
- *Clubiona lena* Bösenberg & Strand, 1906 (Pathak *et al.*, 2020)

4. Ctenidae

- *Ctenus bomdilaensis* Tikader & Malhotra, 1981 (Tikader & Malhotra, 1981; Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Ctenus indicus* Gravely, 1931 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Ctenus kapuri* Tikader, 1973 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Ctenus meghalayaensis* Tikader, 1976 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

5. Gnaphosidae

- *Drassodes himalayensis* Tikader & Gajbe, 1975 (Gajbe, 1988; Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Zelotes mandlaensis* Tikader & Gajbe, 1976 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

6. Halonoproctidae

- *Conothele vali* Siliwal, Nair, Molur & Raven, 2009 (Siliwal *et al.*, 2009, 2011; Caleb & Kumar, 2018)

7. Lycosidae

- *Draposa oakleyi* (Gravely, 1924) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Evippa shivajii* Tikader & Malhotra, 1980 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Hippasa agelenoides* (Simon, 1884) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Hippasa holmerae* Thorell, 1895 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Hippasa partita* (O. Pickard-Cambridge, 1876) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa bistriata* Gravely, 1924 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa carmichaeli* Gravely, 1924 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa fuscana* Pocock, 1901 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa indagatrix* Walckenaer, 1837 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa iranii* Pocock, 1901 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa kempi* Gravely, 1924 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa lambai* Tikader & Malhotra, 1980 (Caleb & Kumar, 2018)
- *Lycosa mackenziei* Gravely, 1924 (Caleb & Kumar, 2018)
- *Lycosa madani* Pocock, 1901 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa pictula* Pocock, 1901 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa poonaensis* Tikader & Malhotra, 1980 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa prolifica* Pocock, 1901 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Lycosa tista* Tikader, 1970 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Pardosa algoides* Schenkel, 1963 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Pardosa heterophthalma* (Simon, 1898) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Pardosa mukundi* Tikader & Malhotra, 1980 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Pathak *et al.*, 2020)
- *Pardosa pusiola* (Thorell, 1891) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Pardosa sumatrana* (Thorell, 1890) (Tikader & Mukerji, 1971; Tikader & Malhotra, 1980; Biswas & Biswas, 2006; Caleb & Kumar, 2018; Abhijith *et al.*, 2021)
- *Pardosa tridentis* Caporiacco, 1935 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Wadicosa fidelis* (O. Pickard-Cambridge, 1872) (Biswas & Biswas, 2006; Caleb & Kumar, 2018

8. Nemesiidae

- *Damarchilus nigricus* Siliwal, Molur & Raven, 2015 (Siliwal *et al.*, 2015a; Caleb & Kumar, 2018)

• *Damarchilus rufus* Siliwal, Molur & Raven, 2015 (Siliwal *et al.*, 2015a; Caleb & Kumar, 2018)

9. Oonopidae

• *Opopaea apicalis* (Simon, 1893) (Pathak *et al.*, 2020)

10. Oxyopidae

• *Oxyopes assamensis* Tikader, 1969 (Gajbe, 1999, 2008; Caleb & Kumar, 2018; Pathak *et al.*, 2020)
• *Oxyopes birmanicus* Thorell, 1887 (Chetry & Moran, 2019)
• *Oxyopes javanus* Thorell, 1887 (Pathak *et al.*, 2020)
• *Oxyopes lineatipes* (C.L. Koch, 1847) (Pathak *et al.*, 2020)
• *Oxyopes salticus* Hentz, 1845 (Chetry & Moran, 2019)
• *Oxyopes shweta* Tikader 1970 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

11. Philodromidae

• *Philodromus assamensis* Tikader, 1962 (Pathak *et al.*, 2020)

12. Pholcidae

• *Crossopriza lyoni* (Blackwall, 1867) (Chetry & Moran, 2019)

13. Pisauridae

• *Dolomedes triton* (Walckenaer, 1837) (Chetry & Moran, 2019)

14. Salticidae

• *Bianor pashanensis* (Tikader, 1975) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
• *Evarcha* sp. (Chetry & Moran, 2019)
• *Harmochirus brachiatus* (Thorell, 1877) (Chetry & Moran, 2019)
• *Hyllus semicupreus* (Simon, 1885) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
• *Myrmarachne dirangicus* Bastawade, 2002 (Bastawade, 2002)
• *Myrmarachne formicaria* (De Geer, 1778) (Chetry & Moran, 2019)
• *Orientattus aurantius* (Kanesharatnam & Benjamin, 2018) (Caleb & Acharya, 2019; Caleb, 2020)
• *Pancorius magnus* Żabka, 1985 (Caleb *et al.*, 2019)
• *Pancorius nagaland* Caleb, 2019 (Caleb *et al.*, 2019)
• *Phidippus tirapensis* Biswas & Biswas, 2006 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
• *Phintella vittata* (C.L. Koch, 1846) (Biswas & Biswas, 2006; Caleb & Kumar, 2018; Chetry & Moran, 2019)
• *Plexippus paykulli* (Audouin, 1825) (Biswas & Biswas, 2006; Caleb & Kumar, 2018; Chetry & Moran, 2019)
• *Plexippus petersi* (Karsch, 1878) (Chetry & Moran, 2019)

15. Sparassidae

• *Heteropoda leprosa* Simon, 1884 (Gravely, 1931)
• *Heteropoda venatoria* (Linnaeus, 1767) (Biswas & Biswas, 2006; Caleb & Kumar, 2018; Chetry & Moran, 2019)
• *Olios milleti* (Pocock, 1901) (Chetry & Moran, 2019)
• *Pseudopoda abnormis* Jäger, 2001 (Jäger, 2001)
• *Pseudopoda cheppe* Caleb, 2018 (Caleb *et al.*, 2018a)

16. Tetragnathidae

- *Leucauge celebesiana* (Walckenaer, 1841) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Leucauge tessellata* (Thorell, 1887) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Leucauge venusta* (Walckenaer, 1841) (Chetry & Moran, 2019)
- *Opadometa fastigata* (Simon, 1877) (Chetry & Moran, 2019)
- *Tetragnatha javana* (Thorell, 1890) (Pathak *et al.*, 2020)
- *Tetragnatha keyserlingi* Simon, 1890 (Pathak *et al.*, 2020)
- *Tetragnatha mandibulata* Walckenaer, 1841 (Pathak *et al.*, 2020)
- *Tetragnatha virescens* Okuma, 1979 (Pathak *et al.*, 2020)

17. Theraphosidae

- *Chilobrachys fumosus* (Pocock, 1895) (Siliwal *et al.*, 2011)
- *Chilobrachys khasiensis* (Tikader, 1977) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Chilobrachys stridulans* (Wood Mason, 1877) (Sen *et al.*, 2012; Caleb & Kumar, 2018)
- *Plesiophrictus meghalayaensis* Tikader, 1977 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

18. Theridiidae

- *Argyrodes* sp. (Chetry & Moran, 2019)
- *Chrysso angula* (Tikader, 1970) (Siliwal, 2009; Caleb & Kumar, 2018)
- *Nesticodes rufipes* (Lucas, 1846) (Chetry & Moran, 2019)
- *Steatoda* sp. (Chetry & Moran, 2019)

19. Thomisidae

- *Camaricus bipunctatus* Bastawade, 2002 (Bastawade, 2002)
- *Camaricus formosus* Thorell, 1887 (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Runcinia insecta* (L. Koch, 1875) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)
- *Stiphropus soureni* Sen, 1964 (Caleb & Kumar, 2018)
- *Xysticus croceus* Fox, 1937 (Tikader, 1971; Biswas & Biswas, 2006; Caleb & Kumar, 2018)

20. Zodariidae

- *Mallinella dibangensis* (Biswas & Biswas, 2006) (Biswas & Biswas, 2006; Caleb & Kumar, 2018)

B. Assam

Assam, one of the largest northeastern states in India, is situated at the foothills of the eastern Himalayas and lies in the middle reach of the river Brahmaputra and Barak between 24.50º and 28.00ºN latitudes and 88.25º and 96.00ºE longitudes covering an area of 78,438 km^2. Assam is known for its wildlife, archeological sites and tea plantations. Assam receives average rainfall exceeds 360 cm; this rain feeds the Brahmaputra and Barak rivers and its tributaries. The topography and the warm and humid climate of Assam are conducive to plant and vegetation growth. Assam is also home to 51 forest and sub-forest types, and the confluence of diverse patterns of vegetation. There are seven national parks and sixteen wild life sanctuaries in the state managed by the forest department. Assam is one of the richest biodiversity zones consisting of tropical rainforests, deciduous forests, riverine grasslands, bamboo orchards and numerous

wetland ecosystems. There are 34 administrative districts of Assam which are demarcated on the basis of geographic features such as rivers, hills, and forests (Fig. 3).

In 19th century, Stoliczka (1869) was the first to describe a species of spider, *Phrynarachne peeliana* (Stoliczka, 1869) and recorded *Herennia multipuncta* (Doleschall, 1859) from Assam. Later, Thorell (1891) described another species *Olios tener* (Thorell, 1891) and recorded *Scytodes fusca* Walckenaer, 1837; and Pocock (1895, 1900, 1901) described four species and recorded other two species from the state. Among the Indian authors, Tikader (1964, 1966a, 1969, 1970, 1971, 1977a, 1982) and his co-workers (Tikader & Malhotra, 1978, 1980, 1981), Tikader & Biswas (1981), Tikader & Bal (1981), Sethi & Tikader (1988), Tikader & Sethi (1990), and Majumder & Tikader (1991) and few other workers reported several species of spiders from different districts of Assam. Three species of spiders, e.g. *Ischnothele indicola* Tikader, 1969; *Philodromus assamensis* Tikader, 1962, and *Runcinia insecta* (L. Koch, 1875) earlier mentioned in fauna of Assam by earlier workers, were indeed recorded from Meghalaya which was carved from Assam in 1972 while one species, *Evippa rubiginosa* Simon, 1885 was recorded from Nagaland which was carved from Assam in 1963.

In recent years, Chetia & Kalita (2012) accounted 81 species of spiders from Hoollongapar Gibbon Sanctuary, Jorhat district; Singh *et al.* (2012) reported 66 species of spiders from Barpeta district; Ahmed *et al.* (2014a, b, 2015) described one species and recorded 27 species from Sonitpur district; Das *et al.* (2015) mentioned 57 species of spiders in Kamrup Metro district; Gupta *et al.* (2015) reported 52 species of spiders from upper Assam; Saha *et al.* (2015) listed 79 species of spiders from different tea growing areas of Assam; Basumatary & Brahma (2017) recorded 60 species from Chakrashila Wildlife Sanctuary, Dhubri and Kokrajhar districts; Ahmed (2018) listed 35 species of spiders from Goalpara district and Pandit (2019) recorded 60 species of spiders from Tinsukia district.

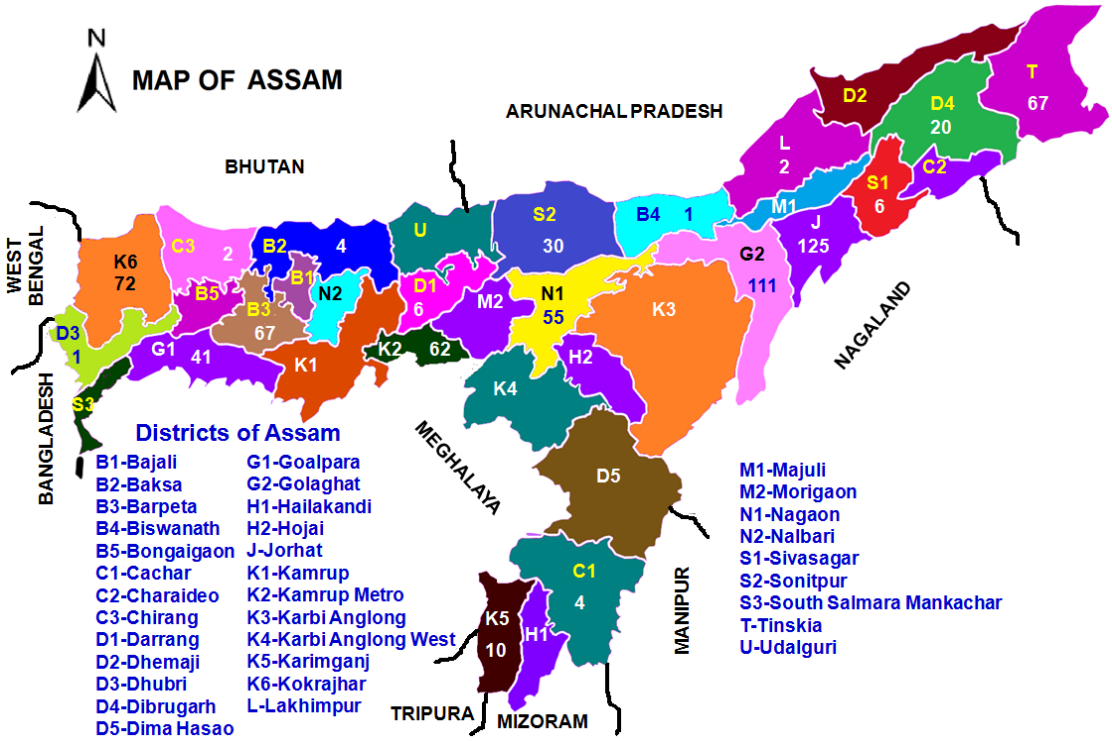

Fig. 3. Number of species of spiders described/recorded from different districts of Assam.

In the present compilation, a total of 266 species described under 136 genera belonging to 27 families were enlisted that have been recorded/described from Assam giving up-to-date information in the light of modern taxonomic concept. Fig. (3) illustrates that the spiders were recorded only in 19 districts out of 34 districts of Assam; maxuimum number of species were found in Jorhat district (125 species) followed by Golaghat (111 species), Kokrajhar (72 species), Barpeta & Tinsukia (67 species each), Kamrup-Metro (62 species) and less number of species of spiders in other districts. Four species of spiders were widely recorded, such as *Argiope pulchella* Thorell, 1881 and *Nephila pilipes* (Fabricius, 1793) (11 districts each) and *Heteropoda venatoria* (Linnaeus, 1767) and *Oxyopes shweta* Tikader, 1970 (10 districts each). Since 44% of the area of Assam is still virgin, an intensive and extensive faunal survey is essentially required in these areas. Following is the list of species of spiders recorded/described from different districts of Assam.

1. Araneidae

- *Acusilas* cf. *coccineus* Simon, 1895 (Roy *et al.*, 2010)
- *Araneus diadematus* Clerck, 1757 (Pandit, 2019)
- *Araneus ellipticus* (Tikader & Bal, 1981) (Saha *et al.*, 2015)
- *Araneus mitificus* (Simon, 1886) (Tikader, 1982; Hazarika & Chakraborti, 1998; Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Araneus* sp. (Das *et al.*, 2015)
- *Argiope aemula* (Walckenaer, 1841) (Levi, 1983; Chetia & Kalita, 2012; Singh *et al.*, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015; Ahmed, 2018)
- *Argiope anasuja* Thorell, 1887 (Singh *et al.*, 2012; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Argiope caesarea* Thorell, 1897 (Tikader, 1982)
- *Argiope catenulata* (Doleschall, 1859) (Singh *et al.*, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018; Borkakati *et al.*, 2018)
- *Argiope magnifica* L. Koch, 1871 (Pandit, 2019)
- *Argiope pulchella* Thorell, 1881 (Tikader, 1982; Hazarika & Chakraborti, 1998; Pathak & Saha, 1998; Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2015; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Borkakati *et al.*, 2018; Pandit, 2019)
- *Argiope trifasciata* (Forsskål, 1775) (Tikader, 1982; Biswas & Majumder, 1995)
- *Chorizopes* sp. (Saha *et al.*, 2015)
- *Cyclosa atrata* Bösenberg & Strand, 1906 (Pandit, 2019)
- *Cyclosa bifida* (Doleschall, 1859) (Singh *et al.*, 2012; Ahmed *et al.*, 2015; Saha *et al.*, 2015; Ahmed, 2018)
- *Cyclosa confraga* (Thorell, 1892) (Tikader, 1982; Singh *et al.*, 2012; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Cyclosa gossypiata* Keswani, 2013 (Ahmed *et al.*, 2015)
- *Cyclosa hexatuberculata* Tikader, 1982 (Singh *et al.*, 2012; Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Cyclosa insulana* (Costa, 1834) (Chetia & Kalita, 2012; Borkakati *et al.*, 2018; Pandit, 2019)
- *Cyclosa mulmeinensis* (Thorell, 1887) (Hazarika & Chakraborti, 1998; Saha *et al.*, 2015)
- *Cyclosa neilensis* Tikader, 1977 (Roy *et al.*, 2017a)
- *Cyclosa purnai* Keswani, 2013 (Basumatary & Brahma, 2017)

- *Cyclosa quinqueguttata* (Thorell, 1881) (Hazarika & Chakraborti, 1998; Saha *et al.*, 2015)
- *Cyclosa simoni* Tikader, 1982 (Hazarika & Chakraborti, 1998; Saha *et al.*, 2015)
- *Cyclosa spirifera* Simon, 1889 (Hazarika & Chakraborti, 1998; Singh *et al.*, 2012; Saha *et al.*, 2015)
- *Cyclosa* sp. (Das *et al.*, 2015; Gupta *et al.*, 2015)
- *Cyrtarachne avimerdaria* Tikader, 1963 (Saha *et al.*, 2015)
- *Cyrtarachne inaequalis* Thorell, 1895 (Tikader, 1982; Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Cyrtarachne nagasakiensis* Strand, 1918 (Basumatary *et al.*, 2018a)
- *Cyrtarachne raniceps* Pocock, 1900 (Gupta *et al.*, 2015)
- *Cyrtarachne* sp. (Chetia & Kalita, 2012)
- *Cyrtophora cicatrosa* (Stoliczka, 1869) (Singh *et al.*, 2012; Saha *et al.*, 2015; Ahmed, 2018)
- *Cyrtophora citricola* (Forsskål, 1775) (Tikader, 1982; Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Das *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Cyrtophora exanthematica* (Doleschall, 1859) (Pandit, 2019)
- *Cyrtophora feae* (Thorell, 1887) (Chetia & Kalita, 2012)
- *Cyrtophora moluccensis* (Doleschall, 1857) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Eriophora transmarina* (Keyserling, 1865) (Pandit, 2019)
- *Eriophora* sp. (Chetia & Kalita, 2012)
- *Eriovixia excelsa* (Simon, 1889) (Das *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Eriovixia kachugaonensis* P. Basumatary, Chanda, Das, Kalita, Brahma, T. Basumatary, B.K. Basumatary & Daimary, 2019 (Basumatary *et al.*, 2019)
- *Eriovixia laglaizei* (Simon, 1877) (Ahmed *et al.*, 2015)
- *Eriovixia* sp. (Gupta *et al.*, 2015; Pandit, 2019)
- *Gasteracantha cancriformis* (Linnaeus, 1758) (Ahmed *et al.*, 2015)
- *Gasteracantha dalyi* Pocock, 1900 (Chetia & Kalita, 2012)
- *Gasteracantha diadesmia* Thorell, 1887 (Chetia & Kalita, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015; Pandit, 2019)
- *Gasteracantha kuhli* C.L. Koch, 1837 (Tikader, 1982; Biswas & Majumder, 1995; Hazarika & Chakraborti, 1998; Chetia & Kalita, 2012; Singh *et al.*, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Gea spinipes* C.L. Koch, 1843 (Ahmed *et al.*, 2015)
- *Gea subarmata* Thorell, 1890 (Saha *et al.*, 2015)
- *Herennia multipuncta* (Doleschall, 1859) (Stoliczka, 1869; Chetia & Kalita, 2012; Singh *et al.*, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Larinia jaysankari* Biswas, 1984 (Majumder, 2005)
- *Macracantha arcuata* (Fabricius, 1793) (Molur *et al.*, 2004)
- *Macracantha hasselti* (C.L. Koch, 1837) (Pocock, 1900; Tikader, 1982; Das *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Neoscona achine* (Simon, 1906) (Tikader, 1982; Biswas & Majumder, 1995)
- *Neoscona bengalensis* Tikader & Bal, 1981 (Chetia & Kalita, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Borkakati *et al.*, 2018)
- *Neoscona biswasi* Bhandari & Gajbe, 2001 (Chetia & Kalita, 2012)

- *Neoscona inusta* (L. Koch, 1871) (Singh *et al.*, 2012)
- *Neoscona mukerjei* Tikader, 1980 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Neoscona nautica* (L. Koch, 1875) (Biswas & Biswas, 1992; Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
- *Neoscona odites* (Simon, 1906) (Tikader & Bal, 1981; Tikader, 1982; Basumatary & Brahma, 2017)
- *Neoscona punctigera* (Doleschall, 1857) (Saha *et al.*, 2015)
- *Neoscona theisi* (Walckenaer, 1841) (Ahmed *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Neoscona vigilans* (Blackwall, 1865) (Saha *et al.*, 2015)
- *Neoscona yptinika* Barrion & Litsinger, 1995 (Saha *et al.*, 2015)
- *Neoscona* sp. (Pathak & Saha, 1998)
- *Nephila kuhli* (Doleschall, 1859) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Nephila pilipes* (Fabricius, 1793) (Tikader, 1982; Biswas & Majumder, 1995; Singh *et al.*, 2012; Biswas & Biswas, 2006; Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Das *et al.*, 2015; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Nephilengys malabarensis* (Walckenaer, 1841) (Das *et al.*, 2015; Pandit, 2019)
- *Ordgarius sexspinosus* (Thorell, 1894) (Saha *et al.*, 2015)
- *Ordgarius* sp. (Chetia & Kalita, 2012)
- *Paraplectana mamoniae* Basumatary & Brahma, 2019 (Basumatary & Brahma, 2019a)
- *Parawixia dehaani* (Doleschall, 1859) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Pasilobus kotigeharus* Tikader, 1963 (Saha *et al.*, 2015)
- *Thelacantha brevispina* (Doleschall, 1857) (Tikader, 1982)
- *Zygiella* sp. (Ahmed *et al.*, 2015)

2. Bemmeridae

- *Damarchus assamensis* Hirst, 1909 (Hirst, 1909; Siliwal *et al.*, 2011)

3. Cheiracanthiidae

- *Cheiracanthium danieli* Tikader, 1975 (Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Cheiracanthium insigne* O. Pickard-Cambridge, 1874 (Gravely, 1931; Tikader & Biswas, 1981)
- *Cheiracanthium melanostomum* (Thorell, 1895) (Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Cheiracanthium* sp. (Das *et al.*, 2015)
- *Eutichurus tezpurensis* Biswas, 1991 (Biswas, 1991)

4. Clubionidae

- *Clubiona bengalensis* Biswas, 1984 (Biswas, 1984; Majumder & Tikader, 1991)
- *Clubiona drassodes* O. Pickard-Cambridge, 1874 (Gupta *et al.*, 2015)
- *Clubiona ludhianaensis* Tikader, 1976 (Majumder & Tikader, 1991; Biswas & Majumder, 1995)
- *Clubiona terrestris* Westring, 1851 (Pandit, 2019)

• *Clubiona* sp. (Basumatary & Brahma, 2017)

5. Corinnidae

• *Castianeira zetes* Simon, 1897 (Gravely, 1931; Majumder & Tikader, 1991; Das *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018)
• *Castianeira* sp. (Chetia & Kalita, 2012)

6. Ctenidae

• *Ctenus sikkimensis* Gravely, 1931 (Gravely, 1931; Tikader & Malhotra, 1981)
• *Ctenus* sp. (Das *et al.*, 2015; Basumatary & Brahma, 2017)

7. Deinopidae

• *Asianopis goalparaensis* (Tikader & Malhotra, 1978) (Tikader & Malhotra, 1978; Basumatary *et al.*, 2020a)

8. Gnaphosidae

• *Drassodes himalayensis* Tikader & Gajbe, 1975 (Gajbe, 2005)
• *Poecilochroa* sp. (Basumatary & Brahma, 2017)
• *Scotophaeus* sp. (Saha *et al.*, 2015)

9. Hersiliidae

• *Hersilia savignyi* Lucas, 1836 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)

10. Idiopidae

• *Scalidognathus* sp. (Basumatary & Brahma, 2017)

11. Linyphiidae

• *Callitrichia formosana* Oi, 1977 (Borkakati *et al.*, 2018)
• *Frontinella pyramitela* (Walckenaer, 1841) (Pandit, 2019)
• *Lepthyphantes bhudbari* Tikader, 1970 (Saha *et al.*, 2015)
• *Lepthyphantes lingsoka* Tikader, 1970 (Saha *et al.*, 2015)
• *Linyphia* sp. (Chetia & Kalita, 2012; Gupta *et al.*, 2015)

12. Lycosidae

• *Evippa praelongipes* (O. Pickard-Cambridge, 1871) (Dhali *et al.*, 2016a)
• *Evippa rubiginosa* Simon, 1885 (Dhali *et al.*, 2016a)
• *Hippasa himalayensis* Gravely, 1924 (Saha *et al.*, 2015)
• *Hippasa* sp. (Pathak & Saha, 1998; Chetia & Kalita, 2012; Das *et al.*, 2015)
• *Lycosa carmichaeli* Gravely, 1924 (Gravely, 1924; Tikader & Malhotra, 1980; Biswas & Biswas, 2006)
• *Lycosa goliathus* Pocock, 1901 (Saha *et al.*, 2015)
• *Lycosa kempi* Gravely, 1924 (Tikader & Malhotra, 1980; Biswas & Majumder, 1995)
• *Lycosa mackenziei* Gravely, 1924 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Basumatary & Brahma, 2017; Ahmed, 2018)
• *Lycosa nigrotibialis* Simon, 1884 (Tikader, 1964; Tikader & Malhotra, 1980; Biswas & Majumder, 1995)
• *Lycosa phipsoni* Pocock, 1899 (Sinha, 1951; Saha *et al.*, 2015)
• *Lycosa tista* Tikader, 1970 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)
• *Lycosa* sp. (Das *et al.*, 2015)

- *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Tikader & Malhotra, 1980; Biswas & Majumder, 1995; Singh *et al.*, 2012; Ahmed *et al.*, 2014c; Singh & Borkotoki, 2014; Das *et al.*, 2015; Basumatary & Brahma, 2017; Borkakati *et al.*, 2018; Pandit, 2019)
- *Pardosa songosa* Tikader & Malhotra, 1976 (Saha *et al.*, 2015)
- *Pardosa sumatrana* (Thorell, 1890) (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Saha *et al.*, 2015; Borkakati *et al.*, 2018)
- *Pardosa* sp. (Pathak & Saha, 1998; Basumatary & Brahma, 2017)
- *Serratacosa himalayensis* (Gravely, 1924) (Tikader, 1964; Biswas & Majumder, 1995)
- *Trochosa urbana* O. Pickard-Cambridge, 1876 (Chetia & Kalita, 2012)
- *Wadicosa fidelis* (O. Pickard-Cambridge, 1872) (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Saha *et al.*, 2015)
- *Wadicosa prasantae* Ahmed *et al.*, 2014 (Ahmed *et al.*, 2014a)

13. Nemesiidae

- *Gravelyia boro* Basumatary & Brahma, 2021 (Basumatary & Brahma, 2021)

14. Oonopidae

- *Brignolia assam* Platnick, Dupérré, Ott & Kranz-Baltensperger, 2011 (Platnick *et al.*, 2011)
- *Prethopalpus meghalaya* Baehr, 2012 (Baehr *et al.*, 2012)
- *Trilacuna loebli* Grismado & Piacentini, 2014 (Grismado *et al.*, 2014)
- *Trilacuna meghalaya* Grismado & Piacentini, 2014 (Grismado *et al.*, 2014)

15. Oxyopidae

- *Hamadruas sikkimensis* (Tikader, 1970) (Das *et al.*, 2015)
- *Hamadruas* sp. (Pandit, 2019)
- *Oxyopes assamensis* Tikader, 1969 (Tikader, 1969a; Chetia & Kalita, 2012)
- *Oxyopes birmanicus* Thorell, 1887 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Pandit, 2019)
- *Oxyopes hotingchiehi* Schenkel, 1963 (Saha *et al.*, 2015)
- *Oxyopes javanus* Thorell, 1887 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Borkakati *et al.*, 2018; Pandit, 2019)
- *Oxyopes lineatipes* (C.L. Koch, 1847) (Chetia & Kalita, 2012)
- *Oxyopes lineatus* Latreille, 1806 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)
- *Oxyopes matiensis* Barrion & Litsinger, 1995 (Roy *et al.*, 2017b)
- *Oxyopes naliniae* Gajbe, 1999 (Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Oxyopes pankaji* Gajbe & Gajbe, 2000 (Chetia & Kalita, 2012; Basumatary & Brahma, 2017)
- *Oxyopes rufisternis* Pocock, 1901 (Chetia & Kalita, 2012)
- *Oxyopes sakuntalae* Tikader, 1970 (Saha *et al.*, 2015)
- *Oxyopes salticus* Hentz, 1845 (Das *et al.*, 2015)
- *Oxyopes scalaris* Hentz, 1845 (Pandit, 2019)
- *Oxyopes shweta* Tikader 1970 (Pathak & Saha, 1998; Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Borkakati *et al.*, 2018; Pandit, 2019)
- *Oxyopes sitae* Tikader, 1970 (Basumatary & Brahma, 2017)
- *Oxyopes sunandae* Tikader 1970 (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Saha *et al.*, 2015)

16. Philodromidae

• *Tibellus elongatus* Tikader, 1960 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)

17. Pholcidae

• *Artema atlanta* Walckenaer, 1837 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
• *Crossopriza lyoni* (Blackwall, 1867) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2014c; Das *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
• *Pholcus phalangioides* (Fuesslin, 1775) (Singh *et al.*, 2012; Ahmed, 2018)
• *Pholcus* sp. (Das *et al.*, 2015)
• *Pribumia atrigularis* (Simon, 1901) (Singh *et al.*, 2012)
• *Smeringopus pallidus* (Blackwall, 1858) (Singh *et al.*, 2012; Ahmed, 2018)

18. Pisauridae

• *Dendrolycosa gitae* (Tikader, 1970) (Chetia & Kalita, 2012; Saha *et al.*, 2015)
• *Dendrolycosa putiana* (Barrion & Litsinger, 1995) (Chetia & Kalita, 2012; Pandit, 2019)
• *Dolomedes* sp. (Pandit, 2019)
• *Nilus albocinctus* (Doleschall, 1859) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Basumatary & Brahma, 2017)
• *Perenethis venusta* L. Koch, 1878 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)
• *Perenethis* sp. (Das *et al.*, 2015; Basumatary & Brahma, 2017)
• *Pisaura* sp. (Chetia & Kalita, 2012)
• *Polyboea vulpina* Thorell, 1895 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)

19. Psechridae

• *Psechrus inflatus* Bayer, 2012 (Chatterjee *et al.*, 2017)
• *Psechrus* sp. (Das *et al.*, 2015)

20. Salticidae

• *Asemonea tenuipes* (O. Pickard-Cambridge, 1869) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Gupta *et al.*, 2015)
• *Bavia* sp. (Chetia & Kalita, 2012; Gupta *et al.*, 2015)
• *Bianor angulosus* (Karsch, 1879) (Logunov, 2001)
• *Bianor narmadaensis* (Tikader, 1975) (Basumatary & Brahma, 2017)
• *Bianor pseudomaculatus* Logunov, 2001 (Logunov, 2019)
• *Bianor tortus* Jastrzebski, 2007 (Jastrzebski, 2007)
• *Brettus cingulatus* Thorell, 1895 (Chetia & Kalita, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015)
• *Brettus* sp. (Das *et al.*, 2015)
• *Carrhotus assam* Caleb, 2020 (Caleb *et al.*, 2020)
• *Carrhotus viduus* (C.L. Koch, 1846) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Saha *et al.*, 2015; Basumatary & Brahma, 2017)
• *Carrhotus* sp. (Das *et al.*, 2015; Pandit, 2019)
• *Chalcotropis* sp. (Saha *et al.*, 2015)
• *Chinattus prabodhi* Basumatary, Das, Caleb & Brahma, 2020 (Basumatary *et al.*, 2020b)
• *Chrysilla acerosa* Wang & Zhang, 2012 (Ahmed *et al.*, 2014b)
• *Chrysilla* sp. (Basumatary & Brahma, 2017)

- *Colyttus proszynskii* Caleb, Chatterjee, Tyagi, Kundu & Kumar, 2018 (Caleb *et al.*, 2018c)
- *Cosmophasis umbratica* Simon, 1903 (Chetia & Kalita, 2012)
- *Dexippus kleini* Thorell, 1891 (Basumatary *et al.*, 2021)
- *Epeus indicus* Prószyński, 1992 (Chetia & Kalita, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015; Pandit, 2019)
- *Epeus tener* (Simon, 1877) (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Gupta *et al.*, 2015)
- *Epeus* sp. (Das *et al.*, 2015)
- *Epocilla aurantiaca* (Simon, 1885) (Saha *et al.*, 2015)
- *Harmochirus* sp. (Pandit, 2019)
- *Hasarius adansoni* (Audouin, 1825) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
- *Hyllus diardi* (Walckenaer, 1837) (Basumatary *et al.*, 2018b)
- *Hyllus semicupreus* (Simon, 1885) (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Borkakati *et al.*, 2018)
- *Indopadilla insularis* (Malamel, Sankaran & Sebastian, 2015) (Basumatary & Brahma, 2017)
- *Menemerus bivittatus* (Dufour, 1831) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Saha *et al.*, 2015; Pandit, 2019)
- *Menemerus brevibulbis* (Thorell, 1887) (Saha *et al.*, 2016)
- *Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869) (Chetia & Kalita, 2012; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Myrmarachne melanocephala* MacLeay, 1839 (Chetia & Kalita, 2012; Das *et al.*, 2015; Basumatary & Brahma, 2017)
- *Myrmarachne robusta* (Peckham & Peckham, 1892) (Saha *et al.*, 2015)
- *Myrmarachne* sp. (Pandit, 2019)
- *Pancorius magnus* Żabka, 1985 (Caleb *et al.*, 2019)
- *Phaeacius* sp. (Basumatary & Brahma, 2017)
- *Phidippus bengalensis* Tikader, 1977 (Saha *et al.*, 2015)
- *Phidippus yashodharae* Tikader, 1977 (Singh *et al.*, 2012; Singh & Borkotoki, 2014)
- *Phintella vittata* (C.L. Koch, 1846) (Chetia & Kalita, 2012; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Phintelloides versicolor* (C.L. Koch, 1846) (Caleb & Acharya, 2020)
- *Plexippus paykulli* (Audouin, 1825) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2014c; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Borkakati *et al.*, 2018; Pandit, 2019)
- *Plexippus petersi* (Karsch, 1878) (Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Ahmed, 2018)
- *Portia assamensis* Wanless, 1978 (Wanless, 1978; Chetia & Kalita, 2012)
- *Portia fimbriata* (Doleschall, 1859) (Gupta *et al.*, 2015)
- *Rhene decorata* Tikader, 1977 (Saha *et al.*, 2015)
- *Rhene flavicomans* Simon, 1902 (Das *et al.*, 2015)
- *Rhene flavigera* (C.L. Koch, 1846) (Gupta *et al.*, 2015)
- *Rhene rubrigera* (Thorell, 1887) (Chetia & Kalita, 2012)
- *Siler semiglaucus* (Simon, 1901) (Das *et al.*, 2015; Basumatary & Brahma, 2017)
- *Synagelides brahmaputra* Caleb, Chatterjee, Tyagi, Kundu & Kumar, 2018 (Caleb *et al.*, 2018c)

- *Telamonia dimidiata* (Simon, 1899) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Thiania bhamoensis* Thorell, 1887 (Chetia & Kalita, 2012; Saha *et al.*, 2015)
- *Vailimia jharbari* Basumatary, Caleb & Das, 2020 (Basumatary *et al.*, 2020c)
- *Zebraplatys* sp. (Basumatary & Brahma, 2017)
- *Zygoballus* sp. (Pathak & Saha, 1998)

21. Scytodidae

- *Scytodes fusca* Walckenaer, 1837 (Thorell, 1891; Das *et al.*, 2015; Pandit, 2019)
- *Scytodes pallida* Doleschall, 1859 (Das *et al.*, 2015; Gupta *et al.*, 2015; Basumatary & Brahma, 2017)
- *Scytodes thoracica* (Latreille, 1802) (Chetia & Kalita, 2012)

22. Sparassidae

- *Gnathopalystes kochi* (Simon, 1880) (Tikader & Sethi, 1990)
- *Heteropoda kandiana* Pocock, 1899 (Majumder, 2005; Saha *et al.*, 2015)
- *Heteropoda leprosa* Simon, 1884 (Sethi & Tikader, 1988; Singh *et al.*, 2012; Singh & Borkotoki, 2014)
- *Heteropoda lunula* (Doleschall, 1857) (Tikader & Sethi, 1990)
- *Heteropoda nilgirina* Pocock, 1901 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Gupta *et al.*, 2015; Ahmed, 2018)
- *Heteropoda phasma* Simon, 1897 (Sethi & Tikader, 1988)
- *Heteropoda venatoria* (Linnaeus, 1767) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2014c; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Neosparassus* sp. (Chetia & Kalita, 2012)
- *Olios milleti* (Pocock, 1901) (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Olios punctipes* Simon, 1884 (Gravely, 1931; Sethi & Tikader, 1988)
- *Olios pyrozonis* (Pocock, 1901) (Pocock, 1901)
- *Olios tener* (Thorell, 1891) (Thorell, 1891; Pocock, 1900)
- *Sinopoda assamensis* Grall & Jäger, 2020 (Grall & Jäger, 2020)

23. Tetragnathidae

- *Leucauge celebesiana* (Walckenaer, 1841) (Tikader, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2006)
- *Leucauge decorata* (Blackwall, 1864) (Tikader, 1982; Biswas & Majumder, 1995; Das *et al.*, 2015; Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Leucauge tessellata* (Thorell, 1887) (Gravely, 1921; Tikader, 1982; Biswas & Majumder, 1995; Chetia & Kalita, 2012; Singh *et al.*, 2012; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Leucauge venusta* (Walckenaer, 1841) (Chetia & Kalita, 2012)
- *Opadometa fastigata* (Simon, 1877) (Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018)
- *Orsinome vethi* (Hasselt, 1882) (Caleb *et al.*, 2018b)
- *Tetragnatha andamanensis* Tikader, 1977 (Pathak & Saha, 1998; Singh *et al.*, 2012)
- *Tetragnatha bengalensis* Walckenaer, 1841 (Borkakati *et al.*, 2018)
- *Tetragnatha ceylonica* O. Pickard-Cambridge 1869 (Saha *et al.*, 2015)

- *Tetragnatha hasselti* Thorell, 1890 (Saha *et al.*, 2015)
- *Tetragnatha javana* (Thorell, 1890) (Singh *et al.*, 2012; Ahmed *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Borkakati *et al.*, 2018; Pandit, 2019)
- *Tetragnatha keyserlingi* Simon, 1890 (Saha *et al.*, 2015; Borkakati *et al.*, 2018)
- *Tetragnatha mandibulata* Walckenaer, 1841 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Ahmed, 2018)
- *Tetragnatha montana* Simon, 1874 (Pandit, 2019)
- *Tetragnatha viridorufa* Gravely, 1921 (Chetia & Kalita, 2012)
- *Tylorida striata* (Thorell, 1877) (Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Gupta *et al.*, 2015; Saha *et al.*, 2015; Basumatary & Brahma, 2017; Pandit, 2019)
- *Tylorida ventralis* (Thorell, 1877) (Chetia & Kalita, 2012; Ahmed *et al.*, 2015; Saha *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
- *Tylorida* sp. (Das *et al.*, 2015)

24. Theraphosidae

- *Chilobrachys assamensis* Hirst, 1909 (Hirst, 1909; Gravely, 1915; Siliwal *et al.*, 2011; Keswani & Vankhede, 2012; Gupta *et al.*, 2015)
- *Chilobrachys fumosus* (Pocock, 1895) (Pocock, 1895)
- *Chilobrachys hardwickei* (Pocock, 1895) (Pandit, 2019)
- *Chilobrachys khasiensis* (Tikader, 1977) (Singh *et al.*, 2012; Singh & Borkotoki, 2014)
- *Chilobrachys stridulans* (Wood Mason, 1877) (Hirst, 1909; Gravely, 1915; Siliwal *et al.*, 2011)
- *Chilobrachys thorelli* Pocock, 1900 (Pocock, 1900; Siliwal *et al.*, 2011)
- *Lyrognathus crotalus* Pocock, 1895 (Pocock, 1895; West & Nunn, 2010)

25. Theridiidae

- *Achaearanea budana* Tikader, 1970 (Saha *et al.*, 2015)
- *Achaearanea* sp. (Das *et al.*, 2015)
- *Argyrodes argentatus* O. Pickard-Cambridge, 1880 (Singh *et al.*, 2012; Das *et al.*, 2015)
- *Argyrodes flavescens* O. Pickard-Cambridge, 1880 (Singh *et al.*, 2012; Gupta *et al.*, 2015)
- *Argyrodes gazedes* Tikader, 1970 (Singh *et al.*, 2012; Saha *et al.*, 2015)
- *Chikunia nigra* (O. Pickard-Cambridge, 1880) (Chetia & Kalita, 2012; Gupta *et al.*, 2015; Pandit, 2019)
- *Chrysso angula* (Tikader, 1970) (Saha *et al.*, 2015; Basumatary & Brahma, 2017)
- *Chrysso urbasae* (Tikader, 1970) (Pandit, 2019)
- *Meotipa andamanensis* (Tikader, 1977) (Singh *et al.*, 2012)
- *Meotipa argyrodiformis* (Yaginuma 1952) (Gupta *et al.*, 2015)
- *Meotipa pulcherrima* (Mello-Leitão, 1917) (Chetia & Kalita, 2012)
- *Meotipa ultapani* Basumatary & Brahma, 2019 (Basumatary & Brahma, 2019b)
- *Nesticodes rufipes* (Lucas, 1846) (Pandit, 2019)
- *Nihonhimea indica* (Tikader, 1977) (Saha *et al.*, 2015)
- *Parasteatoda* sp. (Basumatary & Brahma, 2017)
- *Steatoda* sp. (Chetia & Kalita, 2012)
- *Theridion manjithar* Tikader, 1970 (Singh *et al.*, 2012)
- *Theridion zonulatum* Thorell 1890 (Singh *et al.*, 2012)
- *Theridion* sp. (Pathak & Saha, 1998)

26. Thomisidae

- *Amyciaea forticeps* (O.Pickard- Cambridge, 1873) (Chetia & Kalita, 2012; Gupta *et al.*, 2015)
- *Camaricus formosus* Thorell, 1887 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Singh & Borkotoki, 2014; Das *et al.*, 2015; Gupta *et al.*, 2015; Basumatary & Brahma, 2017; Ahmed, 2018; Pandit, 2019)
- *Indoxysticus minutus* (Tikader, 1960) (Chetia & Kalita, 2012; Das *et al.*, 2015)
- *Misumena vatia* (Clerck, 1757) (Chetia & Kalita, 2012)
- *Misumena* sp. (Das *et al.*, 2015; Saha *et al.*, 2015)
- *Oxytate elongata* (Tikader, 1980) (Das *et al.*, 2015)
- *Oxytate virens* (Thorell, 1891) (Chetia & Kalita, 2012; Das *et al.*, 2015; Ahmed, 2018)
- *Oxytate* sp. (Pandit, 2019)
- *Ozyptila manii* Tikader, 1961 (Saha *et al.*, 2015)
- *Phrynarachne ceylonica* (O. Pickard-Cambridge, 1884) (Das *et al.*, 2019)
- *Phrynarachne peeliana* (Stoliczka, 1869) (Stoliczka, 1869)
- *Phrynarachne* sp. (Pandit, 2019)
- *Platythomisus xiandao* Lin & Li, 2019 (Yadav *et al.*, 2017; for more information see Lin *et al.*, 2019)
- *Thomisus lobosus* Tikader, 1965 (Chetia & Kalita, 2012; Basumatary & Brahma, 2017)
- *Thomisus projectus* Tikader, 1960 (Chetia & Kalita, 2012)
- *Thomisus pugilis* Stoliczka, 1869 (Gupta *et al.*, 2015)
- *Thomisus* sp. (Das *et al.*, 2015; Pandit, 2019)
- *Tmarus* sp. (Basumatary & Brahma, 2017)
- *Xysticus* sp. (Pandit, 2019)

27. Uloboridae

- *Uloborus danolius* Tikader, 1969 (Chetia & Kalita, 2012; Singh *et al.*, 2012; Saha *et al.*, 2015)
- *Uloborus khasiensis* Tikader, 1969 (Saha *et al.*, 2015)
- *Uloborus* sp. (Das *et al.*, 2015; Pandit, 2019)
- *Zosis geniculata* (Olivier, 1789) (Ahmed *et al.*, 2015; Das *et al.*, 2015; Ahmed, 2018; Pandit, 2019)
- *Zosis* sp. (Chetia & Kalita, 2012)

C. Manipur

Manipur is one of the states in northeastern India, it lies at latitudes of 23.83º and 25.68ºN and longitudes of 93.03º and 94.78ºE. It is bordered by Myanmar in the east, Assam to the west, Nagaland to the north, and Mizoram to the south. It occupies an area of 22,327 km^2. There are four major river basins in the state: the Barak River Basin to the west, the Manipur River Basin in central Manipur, the Yu River Basin in the east, and a portion of the Lanye River Basin in the north with several tributaries. The maximum temperature reaches upto 32°C in the summer months, the coldest month is January. The average annual rainfall is about 150 cm between April and mid-October. Natural vegetation occupies nearly two-thirds of the geographical area of the state consisting of short and tall grasses, reeds and trees. The state is covered with over 3,000 km^2 of bamboo forests.

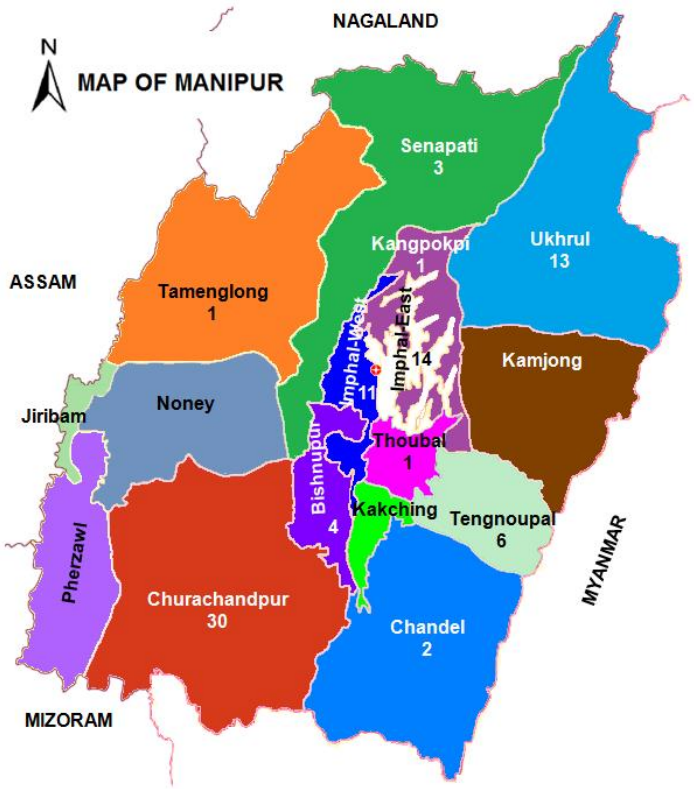

Fig. 4. Number of species of spiders described/recorded from different districts of Manipur.

The faunal survey of spiders in Manipur is very meager. Tikader & Malhotra (1980) was the first to record a spider species *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) from Manipur. Later, Tikader & Biswas (1981) mentioned the presence of another species *Hippasa holmerae* Thorell, 1895 in Manipur. First faunal survey of Manipur was conducted by Biswas & Biswas (2004) who described a new species, *Marpissa manipuriensis* and recorded 51 species providing their localities in different districts of Manipur. Siliwal *et al*. (2015) described another species *Conothele khunthokhanbi* Kananbala, Bhubaneshwari & Siliwal, 2015 from Imphal West district. Very recently, Caleb (2020) described third species of spider, *Phintelloides manipur* from the state. In recent year, Kananbala *et al.* (2018) enlisted 136 valid species under 84 genera belonging to 25 families in Manipur without giving their distribution in different geographic areas.

In the present compilation, a total of 142 species described under 88 genera belonging to 25 families were enlisted that have been recorded/described from Manipur giving up-to-date information in the light of modern taxonomic concept. Fig. (4) illustrates that the maxuimum number of species of spiders were found in Churachandpur district (30 species) followed by Imphal East (14 species), Ukhrul (13 species), Imphal West (11 species), Tengnoupal (6 species), Bishnupur (4 species), Senapati (3 species), Chandel (2 species) and Kangpokpi, Tamenglong and Thoubal (1 species each). No spider was yet mentioned in literature from more than one-fourth of the area of Manipur comprising 5 districts, viz. Jiribam, Kakching, Kamjong, Noney, and Pherzawl. Only one species *Tetragnatha andamanensis* Tikader, 1977 was recorded from 5 districts of Manipur. Hence, intensive and extensive faunal survey is required in almost entire state.

Following is the list of species of spiders recorded/described from different districts of Manipur.

1. Agelenidae

• *Agelena satmila* Tikader, 1970 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

2. Amaurobiidae

• *Amaurobius* sp. (Kananbala *et al.*, 2018)

3. Araneidae

• *Araneus mitificus* (Simon, 1886) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Argiope aemula* (Walckenaer, 1841) (Kananbala *et al.*, 2018)
• *Argiope minuta* Karsch, 1879 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Argiope pulchella* Thorell, 1881 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Cyclosa bifida* (Doleschall, 1859) (Kananbala *et al.*, 2018)
• *Cyclosa spirifera* Simon, 1889 (Kananbala *et al.*, 2018)
• *Cyrtophora cicatrosa* (Stoliczka, 1869) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Cyrtophora citricola* (Forsskål, 1775) (Kananbala *et al.*, 2018)
• *Eriovixia laglaizei* (Simon, 1877) (Kananbala *et al.*, 2018)
• *Gasteracantha kuhli* C.L. Koch, 1837 (Kananbala *et al.*, 2018)
• *Neoscona achine* (Simon, 1906) (Kananbala *et al.*, 2018)
• *Neoscona bengalensis* Tikader & Bal, 1981 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Neoscona mukerjei* Tikader, 1980 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Neoscona nautica* (L. Koch, 1875) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Neoscona theisi* (Walckenaer, 1841) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Neoscona vigilans* (Blackwall, 1865) (Kananbala *et al.*, 2018)
• *Nephila pilipes* (Fabricius, 1793) (Kananbala *et al.*, 2018)
• *Parawixia dehaani* (Doleschall, 1859) (Kananbala *et al.*, 2018)
• *Trichonephila clavata* (L. Koch, 1878) (Kananbala *et al.*, 2018)

4. Cheiracanthiidae

• *Cheiracanthium triviale* (Thorell, 1895) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

5. Clubionidae

• *Clubiona analis* Thorell, 1895 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Clubiona drassodes* O. Pickard-Cambridge, 1874 (Kananbala *et al.*, 2018)
• *Clubiona filicata* O. Pickard-Cambridge, 1874 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Clubiona pallidula* (Clerck, 1757) (Kananbala *et al.*, 2018)

6. Ctenidae

• *Ctenus meghalayaensis* Tikader, 1976 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

7. Gnaphosidae

• *Drassodes gosiutus* Chamberlin, 1919 (Kananbala *et al.*, 2018)
• *Scotophaeus blackwalli* (Thorell, 1871) (Kananbala *et al.*, 2018)
• *Scotophaeus goaensis* (Tikader, 1982) (Kananbala *et al.*, 2018)
• *Zelotes* sp. (Kananbala *et al.*, 2018)

8. Halonoproctidae

• *Conothele khunthokhanbi* Kananbala, Bhubaneshwari & Siliwal, 2015 (Siliwal *et al.*, 2015b; Kananbala *et al.*, 2018)

9. Hersiliidae

• *Hersilia savignyi* Lucas, 1836 (Kananbala *et al.*, 2018)

10. Linyphiidae

• *Atypena* sp. (Kananbala *et al.*, 2018)
• *Erigone bifurca* Locket, 1982 (Kananbala *et al.*, 2018)
• *Labulla* sp. (Kananbala *et al.*, 2018)
• *Neriene sundaica* (Simon, 1905) (Kananbala *et al.*, 2018)

11. Lycosidae

• *Draposa atropalpis* (Gravely, 1924) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Draposa burasantiensis* (Tikader & Malhotra, 1976) (Kananbala *et al.*, 2018)
• *Hippasa greenalliae* (Blackwall, 1867) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Hippasa holmerae* Thorell, 1895 (Tikader & Biswas, 1981; Biswas & Majumder, 2000)
• *Hippasa lycosina* Pocock, 1900 (Kananbala *et al.*, 2018)
• *Hippasa partita* (O. Pickard-Cambridge, 1876) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Hippasa pisaurina* Pocock, 1900 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa barnesi* Gravely, 1924 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa bistriata* Gravely, 1924 (Kananbala *et al.*, 2018)
• *Lycosa iranii* Pocock, 1901 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa kempi* Gravely, 1924 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa madani* Pocock, 1901 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa shillongensis* Tikader & Malhotra, 1980 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Lycosa tista* Tikader, 1970 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Margonia himalayensis* (Gravely, 1924) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Pardosa minuta* Tikader & Malhotra, 1976 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Tikader & Malhotra, 1980; Kananbala *et al.*, 2018)
• *Pardosa rhenockensis* (Tikader, 1970) (Kananbala *et al.*, 2018)
• *Pardosa sumatrana* (Thorell, 1890) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Pardosa timidula* (Roewer, 1951) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Serratacosa himalayensis* (Gravely, 1924) (Biswas & Biswas, 2004)
• *Wadicosa fidelis* (O. Pickard-Cambridge, 1872) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

12. Oxyopidae

• *Oxyopes birmanicus* Thorell, 1887 (Kananbala *et al.*, 2018; Singh *et al.*, 2020)
• *Oxyopes javanus* Thorell, 1887 (Kananbala *et al.*, 2018; Singh *et al.*, 2020)
• *Oxyopes kamalae* Gajbe, 1999 (Kananbala *et al.*, 2018)
• *Oxyopes pandae* Tikader, 1969 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Oxyopes pankaji* Gajbe & Gajbe, 2000 (Kananbala *et al.*, 2018; Singh *et al.*, 2020)

- *Oxyopes ratnae* Tikader, 1970 (Kananbala *et al.*, 2018)
- *Oxyopes shweta* Tikader 1970 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018; Singh *et al.*, 2020)
- *Peucetia viridana* (Stoliczka, 1869) (Kananbala *et al.*, 2018)

13. Philodromidae

- *Philodromus* sp. (Kananbala *et al.*, 2018; Singh *et al.*, 2020)

14. Pholcidae

- *Crossopriza lyoni* (Blackwall, 1867) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Pholcus phalangioides* (Fuesslin, 1775) (Kananbala *et al.*, 2018)
- *Smeringopus pallidus* (Blackwall, 1858) (Kananbala *et al.*, 2018)

15. Pisauridae

- *Pisaura* sp. (Kananbala *et al.*, 2018)

16. Psechridae

- *Psechrus torvus* (O. Pickard-Cambridge, 1869) (Kananbala *et al.*, 2018)

17. Salticidae

- *Aelurillus* sp. (Kananbala *et al.*, 2018)
- *Bianor angulosus* (Karsch, 1879) (Kananbala *et al.*, 2018)
- *Bianor pashanensis* (Tikader, 1975) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Brettus anchorum* Wanless, 1979 (Kananbala *et al.*, 2018)
- *Burmattus pococki* (Thorell, 1895) (Kananbala *et al.*, 2016, 2018)
- *Epeus* sp. (Kananbala *et al.*, 2018)
- *Epocilla praetextata* Thorell, 1887 (Kananbala *et al.*, 2018)
- *Harmochirus brachiatus* (Thorell, 1877) (Kananbala *et al.*, 2018)
- *Hyllus decoratus* Thorell, 1887 (Kananbala *et al.*, 2018)
- *Marpissa manipuriensis* Biswas & Biswas, 2004 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Menemerus brevibulbis* (Thorell, 1887) (Kananbala *et al.*, 2018)
- *Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869) (Kananbala *et al.*, 2018)
- *Myrmarachne calcuttaensis* Biswas, 1984 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Myrmarachne incerta* Narayan, 1915 (Kananbala *et al.*, 2018)
- *Myrmarachne kiboschensis* Lessert, 1925 (Kananbala *et al.*, 2011, 2018)
- *Myrmarachne vulgarisa* Barrion & Litsinger, 1995 (Kananbala *et al.*, 2018)
- *Phidippus punjabensis* Tikader, 1974 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Phintella vittata* (C.L. Koch, 1846) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Phintelloides manipur* Caleb, 2020 (Caleb & Acharya, 2020)
- *Phintelloides versicolor* (C.L. Koch, 1846) (Caleb & Acharya, 2020)
- *Plexippus paykulli* (Audouin, 1825) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018; Singh *et al.*, 2020)
- *Rhene flavigera* (C.L. Koch, 1846) (Kananbala *et al.*, 2018)
- *Rhene rubrigera* (Thorell, 1887) (Kananbala *et al.*, 2018)
- *Thiania bhamoensis* Thorell, 1887 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
- *Yaginumaella* sp. (Kananbala *et al.*, 2018)

18. Scytodidae

• *Scytodes univittata* Simon, 1882 (Kananbala *et al.*, 2018)

19. Sicariidae

• *Loxosceles rufescens* (Dufour, 1820) (Kananbala *et al.*, 2018)

20. Sparassidae

• *Bhutaniella sikkimensis* (Gravely, 1931) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Heteropoda kandiana* Pocock, 1899 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Heteropoda phasma* Simon, 1897 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Heteropoda venatoria* (Linnaeus, 1767) (Kananbala *et al.*, 2018)
• *Olios hampsoni* (Pocock, 1901) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Olios tener* (Thorell, 1891) (Kananbala *et al.*, 2018)
• *Olios wroughtoni* (Simon, 1897) (Kananbala *et al.*, 2018)
• *Spariolenus tigris* Simon, 1880 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

21. Tetragnathidae

• *Guizygiella indica* (Tikader & Bal, 1980) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Guizygiella melanocrania* (Thorell, 1887) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Leucauge decorata* (Blackwall, 1864) (Kananbala *et al.*, 2018)
• *Leucauge tessellata* (Thorell, 1887) (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Mesida culta* (O. Pickard-Cambridge, 1869) (Kananbala *et al.*, 2018)
• *Tetragnatha andamanensis* Tikader, 1977 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Tetragnatha javana* (Thorell, 1890) (Kananbala *et al.*, 2018)
• *Tetragnatha mandibulata* Walckenaer, 1841 (Kananbala *et al.*, 2018)
• *Tetragnatha nitens* (Savigny, 1825) (Kananbala *et al.*, 2018)
• *Tetragnatha virescens* Okuma, 1979 (Kananbala *et al.*, 2018)
• *Tetragnatha viridorufa* Gravely, 1921 (Kananbala *et al.*, 2018)

22. Theraphosidae

• *Lyrognathus* sp. (Kananbala *et al.*, 2018)
• *Selenocosmia* sp. (Kananbala *et al.*, 2018)

23. Theridiidae

• *Argyrodes argentatus* O. Pickard-Cambridge, 1880 (Kananbala *et al.*, 2018)
• *Latrodectus elegans* Thorell, 1898 (Kananbala *et al.*, 2012, 2018)
• *Nihonhimea brookesiana* (Barrion & Litsinger, 1995) (Kananbala *et al.*, 2018)
• *Steatoda* sp. (Kananbala *et al.*, 2018)
• *Theridion* sp. (Kananbala *et al.*, 2018)
• *Theridula* sp. (Kananbala *et al.*, 2018)

24. Thomisidae

• *Amyciaea forticeps* (O. Pickard-Cambridge, 1873) (Kananbala *et al.*, 2018)
• *Camaricus formosus* Thorell, 1887 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)
• *Diaea bengalensis* Biswas & Mazumder, 1981 (Biswas & Biswas, 2004; Kananbala *et al.*, 2018)

• *Diaea dorsata* (Fabricius, 1777) (Kananbala *et al.*, 2018)
• *Indoxysticus minutus* (Tikader, 1960) (Kananbala *et al.*, 2018)
• *Massuria sreepanchamii* (Tikader, 1962) (Kananbala *et al.*, 2018)
• *Misumena* sp. (Kananbala *et al.*, 2018)
• *Oxytate elongata* (Tikader, 1980) (Kananbala *et al.*, 2018)
• *Oxytate virens* (Thorell, 1891) (Kananbala *et al.*, 2018)
• *Runcinia acuminata* (Thorell, 1881) (Kananbala *et al.*, 2018)
• *Runcinia insecta* (L. Koch, 1875) (Kananbala *et al.*, 2018)
• *Thomisus projectus* Tikader, 1960 (Biswas & Biswas, 2004)
• *Tmarus* sp. (Kananbala *et al.*, 2018)

25. Uloboridae

• *Miagrammopes extensus* Simon, 1889 (Kananbala *et al.*, 2018)
• *Zosis geniculata* (Olivier, 1789) (Kananbala *et al.*, 2018)

D. Meghalaya

One of the northeast states, Meghalaya, the wettest region of India, was formed by carving two districts, the United Khasi Hills and Jaintia Hills, and the Garo Hills from the state of Assam in 1972. Later, these two districts were subdivided into 11 administrative districts (Fig. 5). Meghalaya is bordered on the north and east by Assam and on the south and west by Bangladesh and covers an area of 22,429 km^2. It lies between 20.1º and 26.5ºN latitudes and 85.49º and 92.52ºE longitudes. The state is mountainous, with stretches of valley and highland plateaus. The wettest areas in the southern Khasi Hills receive an average of 1,200 cm of rain a year. More than two-thirds of the area of the state is covered with subtropical forests having highly rich biodiversity of flora and fauna. There are several rivers in the state; some of them in Khasi Hill areas have created several waterfalls. Meghalaya has four wildlife sanctuaries and two National Parks.

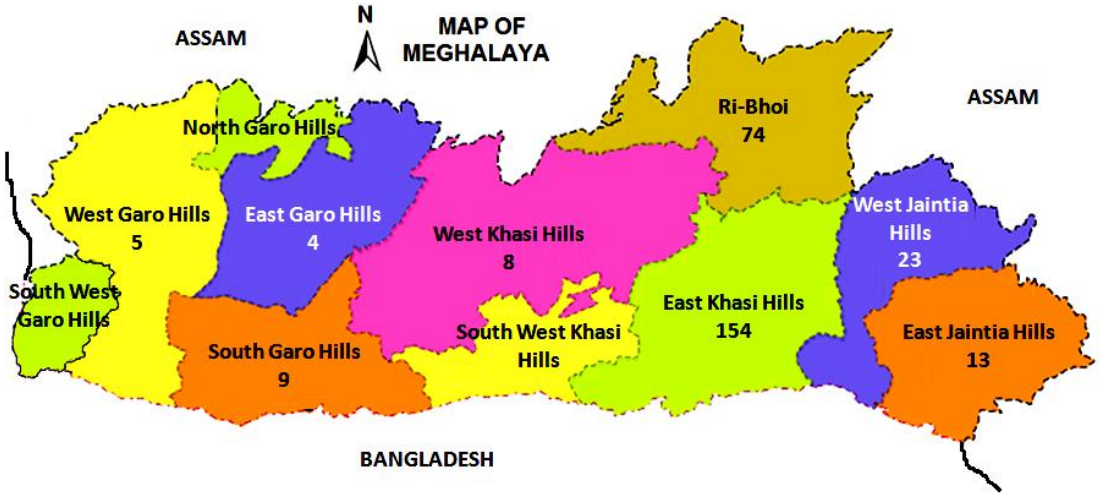

Fig. 5. Number of species of spiders described/recorded from different districts of Meghalaya.

The faunal survey of spiders in Meghalaya is scanty. Most of the surveys were carried out in East and West Jayantia Hills (Tikader, 1966a,b, 1968, 1969; Bhattacharya *et al.*, 2017), East Khasi Hills (Tikader, 1966a,b, 1968, 1969; Biswas & Majumder, 1995) and Ri-Bhoi (Nakambam *et al.*, 2021) districts. Pocock (1900) was seemingly the first to

describe a spider, *Lyrognathus saltator* and recorded three species, *Lyrognathus crotalus* Pocock, 1895, *Thelacantha brevispina* (Doleschall, 1857), and *Trichonephila clavata* (L. Koch, 1878) from Meghalaya and after a year, he (Pocock, 1901) again described four new species of spiders from Meghalaya, *Leucauge beata*, *Orsinome armata*, *Tetragnatha coelestis*, and *Tetragnatha paradisea*. After two decades, Gravely (1921, 1931), Fage (1924), and Kemp (1924) described and recorded 8 more species of spiders from Meghalaya. Among the Indian authors, Tikader (1961) was first to describe *Ozyptila khasi* from the state. Thereafter, Tikader (1962, 1964, 1966a,b,c, 1968, 1969, 1970, 1976, 1977, 1980, 1982), Sen (1963), Tikader & Gajbe (1976, 1977), Barman (1974, 1978a,b, 1979), Tikader & Malhotra (1980), Tikader & Bal (1981), Tikader & Biswas (1981), Sethi & Tikader (1988), Majumder & Tikader (1991) etc. have described and recorded several spider species from different regions of Meghalaya. First faunal survey of Meghalaya was conducted long back by Biswas & Majumder (1995) who mentioned 89 species of spiders from Meghalaya. In recent years, Bhattacharya *et al.* (2017) enlisted 21 species of spiders from Jaintia Hills, while Roy *et al.* (2017b), and Nakambam *et al.* (2021) listed 55 species and 20 species of spiders, respectively from Ri-Bhoi district.

In the present compilation, a total of 225 species described under 119 genera belonging to 29 families were enlisted that have been recorded/described from Meghalaya giving up-to-date information in the light of modern taxonomic concept. Scrutiny of the records mentioned in literature demonstrated that most of the species were either described/recorded from United Khasi Hills (207 species of spiders) and Jaintia Hills (34 species of spiders). Only 17 species were recorded in Garo Hills region. Fig. (5) illustrates that the maxuimum number of species of spiders were described/recorded from East Khasi Hills district (154 species) followed by Ri-Bhoi (74 species), West Jaintia Hills (23 species), East Jaintia Hills (13 species), South Garo Hills (9 species), West Khasi Hills (8 species), West Garo Hills (5 species), and East Garo Hills (4 species) districts. No spider was yet mentioned in literature from 3 districts, viz. South West Khasi Hills, North Garo Hills, and South West Garo Hills. Only two species, *Nephila pilipes* (Fabricius, 1793) (10 districts) and *Leucauge decorata* (Blackwall, 1864) (8 districts) are widely distributed. Hence, intensive and extensive faunal survey is required in almost entire state. Following is the list of species of spiders recorded/described from different districts of Meghalaya.

1. Agelenidae

- *Agelena gautami* Tikader, 1962 (Tikader, 1962a; Barman, 1979)
- *Agelena oaklandensis* Barman, 1979 (Barman, 1979)
- *Agelena shillongensis* Tikader, 1969 (Tikader, 1969b; Barman, 1979)
- *Tegenaria shillongensis* Barman, 1979 (Barman, 1979)

2. Araneidae

- *Acusilas coccineus* Simon, 1895 (Roy *et al.*, 2017b)
- *Araneus ellipticus* (Tikader & Bal, 1981) (Biswas & Majumder, 1995)
- *Araneus mitificus* (Simon, 1886) (Roy *et al.*, 2017b; Nakambam *et al.*, 2021)
- *Araniella cucurbitina* (Clerck, 1757) (Tikader & Biswas, 1981; Tikader, 1982; Biswas & Majumder, 1995; Zamani & Marusik, 2020)
- *Argiope aemula* (Walckenaer, 1841) (Roy *et al.*, 2017b)
- *Argiope minuta* Karsch, 1879 (Tikader & Biswas, 1981; Tikader, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2006)
- *Argiope pulchella* Thorell, 1881 (Biswas & Majumder, 1995; Biswas & Biswas, 2004, 2007; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)

- *Argiope trifasciata* (Forsskål, 1775) (Barman, 1974; Tikader, 1982; Biswas & Majumder, 1995)
- *Chorizopes quadrituberculata* Roy, Sen, Saha & Raychaudhuri, 2014 (Roy *et al.*, 2017b)
- *Cyclosa bifida* (Doleschall, 1859) (Tikader, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2006; Roy *et al.*, 2017b)
- *Cyclosa confraga* (Thorell, 1892) (Nakambam *et al.*, 2021)
- *Cyclosa hexatuberculata* Tikader, 1982 (Nakambam *et al.*, 2021)
- *Cyclosa insulana* (Costa, 1834) (Tikader, 1966b, 1982; Barman, 1974; Biswas & Majumder, 1995; Nakambam *et al.*, 2021)
- *Cyclosa krusa* Barrion & Litsinger, 1995 (Roy *et al.*, 2017b)
- *Cyclosa moonduensis* Tikader, 1963 (Roy *et al.*, 2017b)
- *Cyclosa mulmeinensis* (Thorell, 1887) (Roy *et al.*, 2017b)
- *Cyclosa quinqueguttata* (Thorell, 1881) (Roy *et al.*, 2017b)
- *Cyclosa spirifera* Simon, 1889 (Roy *et al.*, 2017b)
- *Cyrtarachne avimerdaria* Tikader, 1963 (Biswas & Majumder, 1995; Barman, 1974)
- *Cyrtarachne inaequalis* Thorell, 1895 (Roy *et al.*, 2017b)
- *Cyrtophora feae* (Thorell, 1887) (Bhattacharya *et al.*, 2017)
- *Eriovixia excelsa* (Simon, 1889) (Roy *et al.*, 2017b)
- *Gasteracantha dalyi* Pocock, 1900 (Bhattacharya *et al.*, 2017)
- *Gasteracantha diadesmia* Thorell, 1887 (Biswas & Majumder, 1995; Roy *et al.*, 2017b)
- *Gasteracantha kuhli* C.L. Koch, 1837 (Biswas & Majumder, 1995; Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
- *Herennia multipuncta* (Doleschall, 1859) (Tikader, 1982; Biswas & Majumder, 1995; Bhattacharya *et al.*, 2017)
- *Larinia chloris* (Savigny, 1825) (Biswas & Majumder, 1995)
- *Macracantha arcuata* (Fabricius, 1793) (Tikader, 1982; Biswas & Majumder, 1995)
- *Macracantha hasselti* (C.L. Koch, 1837) (Roy *et al.*, 2017b)
- *Neogea nocticolor* (Thorell, 1887) (Nakambam *et al.*, 2021)
- *Neoscona achine* (Simon, 1906) (Biswas & Majumder, 1995)
- *Neoscona bengalensis* Tikader & Bal, 1981 (Biswas & Majumder, 1995; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)
- *Neoscona mukerjei* Tikader, 1980 (Biswas & Majumder, 1995; Bhattacharya *et al.*, 2017; Nakambam *et al.*, 2021)
- *Neoscona nautica* (L. Koch, 1875) (Tikader & Bal, 1981; Tikader & Biswas, 1981; Biswas & Majumder, 1995; Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
- *Neoscona punctigera* (Doleschall, 1857) (Roy *et al.*, 2017b)
- *Neoscona shillongensis* Tikader & Bal, 1981 (Tikader & Bal, 1981; Tikader & Biswas, 1981; Tikader, 1982; Biswas & Majumder, 1995; Roy *et al.*, 2017b)
- *Neoscona theisi* (Walckenaer, 1841) (Biswas & Majumder, 1995; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)
- *Neoscona yptinika* Barrion & Litsinger, 1995 (Roy *et al.*, 2017b)
- *Nephila pilipes* (Fabricius, 1793) (Tikader & Biswas, 1981; Biswas & Majumder, 1995, 2000; Biswas & Biswas, 2006; Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
- *Parawixia dehaani* (Doleschall, 1859) (Roy *et al.*, 2017b)
- *Thelacantha brevispina* (Doleschall, 1857) (Tikader, 1970, 1982; Tikader & Biswas, 1981)
- *Trichonephila clavata* (L. Koch, 1878) (Pocock, 1900; Biswas & Majumder, 1995; Saha *et al.*, 2016)

3. Cheiracanthiidae

- *Cheiracanthium himalayense* Gravely, 1931 (Majumder & Tikader, 1991; Biswas & Majumder, 1995; Saha *et al.*, 2016)
- *Cheiracanthium indicum* O. Pickard-Cambridge, 1874 (Majumder & Tikader, 1991; Biswas & Biswas, 1992; Biswas & Majumder, 1995)
- *Cheiracanthium melanostomum* (Thorell, 1895) (Biswas & Majumder, 1995; Roy *et al.*, 2017b)
- *Cheiracanthium saraswatii* Tikader, 1962 (Tikader, 1962a; Majumder & Tikader, 1991; Biswas & Majumder, 1995)
- *Cheiracanthium triviale* (Thorell, 1895) (Biswas & Majumder, 1995)

4. Clubionidae

- *Clubiona ludhianaensis* Tikader, 1976 (Majumder & Tikader, 1991; Biswas & Majumder, 1995)
- *Clubiona shillongensis* Majumder & Tikader, 1991 (Majumder & Tikader, 1991; Biswas & Majumder, 1995)

5. Ctenidae

- *Amauropelma ekeftys* Jäger, 2012 (Jäger, 2012)
- *Ctenus meghalayaensis* Tikader, 1976 (Tikader, 1976; Tikader & Malhotra, 1981)

6. Gnaphosidae

- *Drassodes himalayensis* Tikader & Gajbe, 1975 (Tikader, 1982; Gajbe, 1988; Biswas & Biswas, 2006)
- *Drassodes meghalayaensis* Tikader & Gajbe, 1977 (Tikader & Gajbe, 1977; Biswas & Majumder, 1995)
- *Drassodes sirmourensis* (Tikader & Gajbe, 1977) (Biswas & Majumder, 1995)
- *Haplodrassus signifer* (C.L. Koch, 1839) (Barman, 1974)
- *Hitobia meghalayensis* (Tikader & Gajbe, 1976) (Tikader & Gajbe, 1976; Tikader, 1982)
- *Poecilochroa barmani* Tikader, 1982 (Tikader, 1982; Biswas & Majumder, 1995)

7. Hersiliidae

- *Hersilia savignyi* Lucas, 1836 (Bhattacharya *et al.*, 2017)

8. Idiopidae

- *Heligmomerus garoensis* (Tikader, 1977) (Tikader, 1977a)

9. Ischnothelidae

- *Ischnothele indicola* Tikader, 1969 (Tikader, 1969b; Siliwal *et al.*, 2011)

10. Linyphiidae

- *Atypena cirrifrons* (Heimer, 1984) (Tanasevitch, 2019)
- *Caviphantes pseudosaxetorum* Wunderlich, 1979 (Tanasevitch, 2011)
- *Indophantes bengalensis* Saaristo & Tanasevitch, 2003 (Saaristo & Tanasevitch, 2003)
- *Lepthyphantes lingsoka* Tikader, 1970 (Barman, 1974)
- *Nasoona asocialis* (Wunderlich, 1974) (Tanasevitch, 2011, 2017a)
- *Neriene sundaica* (Simon, 1905) (Roy *et al.*, 2017b)
- *Oedothorax khasi* Tanasevitch, 2017 (Tanasevitch, 2017b)
- *Oedothorax meghalaya* Tanasevitch, 2015 (Tanasevitch, 2015)

• *Oedothorax sohra* Tanasevitch, 2020 (Tanasevitch, 2020a)
• *Oedothorax unciger* Tanasevitch, 2020 (Tanasevitch, 2020a)
• *Oedothorax uncus* Tanasevitch, 2015 (Tanasevitch, 2015)
• *Ummeliata insecticeps* (Bösenberg & Strand, 1906) (Tanasevitch, 2020b)
• *Walckenaeria saetigera* Tanasevitch, 2011 (Tanasevitch, 2011)

11. Liocranidae

• *Oedignatha shillongensis* Biswas & Majumder, 1995 (Biswas & Majumder, 1995)

12. Lycosidae

• *Arctosa khudiensis* (Sinha, 1951) (Biswas & Majumder, 1995)
• *Arctosa mulani* (Dyal, 1935) (Biswas & Majumder, 1995)
• *Evippa banarensis* Tikader & Malhotra, 1980 (Biswas & Majumder, 1995)
• *Evippa praelongipes* (O. Pickard-Cambridge, 1871) (Biswas & Majumder, 1995)
• *Hippasa lycosina* Pocock, 1900 (Biswas & Majumder, 1995)
• *Hippasa madraspatana* Gravely, 1924 (Biswas & Majumder, 1995)
• *Hippasa* sp. (Bhattacharya *et al.*, 2017)
• *Lycosa barnesi* Gravely, 1924 (Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Lycosa carmichaeli* Gravely, 1924 (Barman, 1974; Biswas & Biswas, 2006)
• *Lycosa geotubalis* Tikader & Malhotra, 1980 (Biswas & Majumder, 1995)
• *Lycosa iranii* Pocock, 1901 (Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Lycosa kempi* Gravely, 1924 (Biswas & Majumder, 1995)
• *Lycosa mackenziei* Gravely, 1924 (Bhattacharya *et al.*, 2017; Nakambam *et al.*, 2021)
• *Lycosa nigrotibialis* Simon, 1884 (Biswas & Majumder, 1995)
• *Lycosa shillongensis* Tikader & Malhotra, 1980 (Tikader & Malhotra, 1980; Biswas & Majumder, 1995; Roy *et al.*, 2017b)
• *Margonia himalayensis* (Gravely, 1924) (Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Ocyale pilosa* (Roewer, 1960) (Biswas & Majumder, 1995)
• *Pardosa heterophthalma* (Simon, 1898) (Biswas & Majumder, 1995; Biswas & Biswas, 2006)
• *Pardosa minuta* Tikader & Malhotra, 1976 (Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Tikader, 1964; Biswas & Majumder, 1995)
• *Pardosa sumatrana* (Thorell, 1890) (Tikader & Malhotra, 1980; Biswas & Majumder, 1995; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)
• *Pardosa sutherlandi* (Gravely, 1924) (Biswas & Majumder, 1995)
• *Serratacosa himalayensis* (Gravely, 1924) (Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Shapna pluvialis* Hippa & Lehtinen, 1983 (Hippa & Lehtinen, 1983)
• *Wadicosa fidelis* (O. Pickard-Cambridge, 1872) (Tikader & Malhotra, 1980; Biswas & Majumder, 1995; Biswas & Biswas, 2006; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)

13. Mimetidae

• *Mimetus* sp. (Nakambam *et al.*, 2021)

14. Oecobiidae

• *Oecobius annulipes* Lucas, 1846 (Barman, 1974)
• *Oecobius chiasma* Barman, 1978 (Barman, 1978a)

15. Oonopidae

• *Dysderoides synrang* Grismado & Deeleman, 2014 (Grismado *et al.*, 2014)
• *Ischnothyreus shillongensis* Tikader, 1968 (Tikader, 1968, 1969; Barman, 1974)
• *Prethopalpus khasi* Baehr, 2012 (Baehr *et al.*, 2012)
• *Prethopalpus meghalaya* Baehr, 2012 (Baehr *et al.*, 2012)
• *Triaeris khashiensis* Tikader, 1966 (Tikader, 1966b, 1969)
• *Trilacuna besucheti* Grismado & Piacentini, 2014 (Grismado *et al.*, 2014)
• *Trilacuna meghalaya* Grismado & Piacentini, 2014 (Grismado *et al.*, 2014)

16. Oxyopidae

• *Hamadruas sikkimensis* (Tikader, 1970) (Biswas & Majumder, 1995; Gajbe, 2008)
• *Oxyopes assamensis* Tikader, 1969 (Tikader, 1969a; Barman, 1974)
• *Oxyopes bharatae* Gajbe, 1999 (Nakambam *et al.*, 2021)
• *Oxyopes javanus* Thorell, 1887 (Roy *et al.*, 2017b)
• *Oxyopes kamalae* Gajbe, 1999 (Roy *et al.*, 2017b)
• *Oxyopes matiensis* Barrion & Litsinger, 1995 (Roy *et al.*, 2017b)
• *Oxyopes rufisternis* Pocock, 1901 (Bhattacharya *et al.*, 2017)
• *Oxyopes shweta* Tikader, 1970 (Biswas & Majumder, 1995; Gajbe, 2008; Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
• *Oxyopes sitae* Tikader, 1970 (Biswas & Majumder, 1995; Gajbe, 2008; Saha *et al.*, 2016)
• *Oxyopes sunandae* Tikader 1970 (Biswas & Majumder, 1995; Gajbe, 2008)
• *Oxyopes tikaderi* Biswas & Majumder, 1995 (Biswas & Majumder, 1995; Gajbe, 2008)
• *Peucetia latikae* Tikader, 1970 (Biswas & Majumder, 1995; Gajbe, 2008)

17. Philodromidae

• *Philodromus assamensis* Tikader, 1962 (Tikader, 1962a; Tikader, 1971, 1980; Tikader & Biswas, 1981; Biswas & Majumder, 1995)
• *Philodromus barmani* Tikader, 1980 (Tikader, 1980; Biswas & Majumder, 1995)
• *Philodromus decoratus* Tikader, 1962 (Tikader, 1962b, 1971, 1980; Biswas & Majumder, 1995)
• *Philodromus domesticus* Tikader, 1962 (Tikader, 1962b, 1971, 1980)
• *Philodromus manikae* Tikader, 1971 (Tikader, 1971, 1980; Biswas & Majumder, 1995)
• *Philodromus shillongensis* Tikader, 1962 (Tikader, 1962b, 1968, 1971, 1980; Biswas & Majumder, 1995)
• *Philodromus tiwarii* Basu, 1973 (Basu, 1973; Tikader, 1980)

18. Pholcidae

• *Pholcus medog* Zhang, Zhu & Song, 2006 (Huber, 2011)

19. Pisauridae

• *Dendrolycosa gitae* (Tikader, 1970) (Roy *et al.*, 2017b)

20. Salticidae

• *Bianor balius* Thorell, 1890 (Logunov, 2001, 2019)
• *Bianor narmadaensis* (Tikader, 1975) (Biswas & Biswas, 1992; Biswas & Majumder, 1995)
• *Bianor pseudomaculatus* Logunov, 2001 (Logunov, 2001, 2019)
• *Eupoa lehtineni* Logunov & Marusik, 2014 (Logunov & Marusik, 2014)
• *Hasarius adansoni* (Audouin, 1825) (Nakambam *et al.*, 2021)

• *Hyllus semicupreus* (Simon, 1885) (Roy *et al.*, 2017b)
• *Myrmarachne caliraya* Barrion & Litsinger, 1995 (Roy *et al.*, 2017b)
• *Phintella assamica* Prószyński, 1992 (Prószyński, 1992)
• *Phintella vittata* (C.L. Koch, 1846) (Roy *et al.*, 2017b)
• *Plexippus paykulli* (Audouin, 1825) (Biswas & Majumder, 1995; Roy *et al.*, 2017b; Nakambam *et al.*, 2021)
• *Pseudicius andamanius* (Tikader, 1977) (Biswas & Majumder, 1995)
• *Rhene decorata* Tikader, 1977 (Roy *et al.*, 2017b)
• *Telamonia dimidiata* (Simon, 1899) (Roy *et al.*, 2017b)
• *Thiania bhamoensis* Thorell, 1887 (Roy *et al.*, 2017b)

21. Scytodidae

• *Scytodes mawphlongensis* Tikader, 1966 (Tikader, 1966c, 1969; Barman, 1974)
• *Scytodes propinqua* Stoliczka, 1869 (Barman, 1974)
• *Scytodes semipullata* (Simon, 1909) (Kemp, 1924)
• *Scytodes thoracica* (Latreille, 1802) (Bhattacharya *et al.*, 2017)

22. Sparassidae

• *Bhutaniella sikkimensis* (Gravely, 1931) (Sethi & Tikader, 1988; Saha *et al.*, 2016)
• *Eusparassus xerxes* (Pocock, 1901) (Sethi & Tikader, 1988)
• *Heteropoda fischeri* Jäger, 2005 (Jäger, 2005)
• *Heteropoda kandiana* Pocock, 1899 (Gravely, 1931; Sethi & Tikader, 1988)
• *Heteropoda robusta* Fage, 1924 (Fage, 1924; Sethi & Tikader, 1988; Jäger, 2005)
• *Heteropoda venatoria* (Linnaeus, 1767) (Barman, 1974)
• *Olios gravelyi* Sethi & Tikader, 1988 (Sethi & Tikader, 1988)
• *Olios tener* (Thorell, 1891) (Roy *et al.*, 2017b)
• *Pseudopoda akashi* (Sethi & Tikader, 1988) (Sethi & Tikader, 1988)
• *Pseudopoda perplexa* Jäger, 2008 (Jäger, 2008)
• *Pseudopoda shillongensis* (Sethi & Tikader, 1988) (Sethi & Tikader, 1988)

23. Tetrablemmidae

• *Brignoliella besuchetiana* Bourne, 1980 (Bourne, 1980)

24. Tetragnathidae

• *Guizygiella* sp. (Nakambam *et al.*, 2021)
• *Leucauge beata* (Pocock, 1901) (Pocock, 1901)
• *Leucauge celebesiana* (Walckenaer, 1841) (Gravely, 1921; Tikader, 1970, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2006; Roy *et al.*, 2017b)
• *Leucauge decorata* (Blackwall, 1864) (Gravely, 1921; Tikader, 1982; Biswas & Majumder, 1995; Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
• *Leucauge granulata* (Walckenaer, 1841) (Barman, 1974)
• *Leucauge tessellata* (Thorell, 1887) (Barman, 1974; Biswas & Majumder, 1995; Roy *et al.*, 2017b)
• *Orsinome armata* Pocock, 1901 (Pocock, 1901)
• *Tetragnatha ceylonica* O. Pickard-Cambridge, 1869 (Barman, 1974; Roy *et al.*, 2017b)
• *Tetragnatha coelestis* Pocock, 1901 (Pocock, 1901; Barman, 1974)
• *Tetragnatha fletcheri* Gravely, 1921 (Gravely, 1921)
• *Tetragnatha geniculata* Karsch, 1892 (Barman, 1974)
• *Tetragnatha javana* (Thorell, 1890) (Tikader, 1970; Barman, 1974)
• *Tetragnatha keyserlingi* Simon, 1890 (Barman, 1974)

• *Tetragnatha mandibulata* Walckenaer, 1841 (Bhattacharya *et al.*, 2017)
• *Tetragnatha moulmeinensis* Gravely, 1921 (Barman, 1974)
• *Tetragnatha paradisea* Pocock, 1901 (Pocock, 1901; Barman, 1974)
• *Tetragnatha sutherlandi* Gravely, 1921 (Barman, 1974)
• *Tetragnatha vermiformis* Emerton, 1884 (Barman, 1974)
• *Tylorida striata* (Thorell, 1877) (Roy *et al.*, 2017b)
• *Tylorida ventralis* (Thorell, 1877) (Bhattacharya *et al.*, 2017)

25. Theraphosidae

• *Chilobrachys himalayensis* (Tikader, 1977) (Dhali *et al.*, 2016b)
• *Chilobrachys khasiensis* (Tikader, 1977) (Tikader, 1977a; Biswas & Biswas, 2006, 2007; Siliwal *et al.*, 2011)
• *Haploclastus satyanus* (Barman, 1978) (Barman, 1978b; Siliwal *et al.*, 2011)
• *Lyrognathus crotalus* Pocock, 1895 (Gravely, 1935; West & Nunn, 2010; Siliwal *et al.*, 2011)
• *Lyrognathus saltator* Pocock, 1900 (Pocock, 1900; West & Nunn, 2010; Siliwal *et al.*, 2011)
• *Plesiophrictus meghalayaensis* Tikader, 1977 (Tikader, 1977a; Biswas & Biswas, 2006; Siliwal *et al.*, 2011)

26. Theridiidae

• *Achaearanea budana* Tikader, 1970 (Roy *et al.*, 2017b)
• *Argyrodes gazedes* Tikader, 1970 (Roy *et al.*, 2017b)
• *Chikunia nigra* (O. Pickard-Cambridge, 1880) (Bhattacharya *et al.*, 2017)
• *Chrysso urbasae* (Tikader, 1970) (Roy *et al.*, 2017b)
• *Meotipa pulcherrima* (Mello-Leitão, 1917) (Bhattacharya *et al.*, 2017)
• *Nesticodes rufipes* (Lucas, 1846) (Kemp, 1924)
• *Nihonhimea indica* (Tikader, 1977) (Roy *et al.*, 2017b)
• *Nihonhimea tesselata* (Keyserling, 1884) (Barman, 1974)
• *Parasteatoda tepidariorum* (C.L. Koch, 1841) (Barman, 1974)
• *Ruborridion* sp. (Nakambam *et al.*, 2021)

27. Theridiosomatidae

• *Wendilgarda assamensis* Fage, 1924 (Fage, 1924; Kemp, 1924)

28. Thomisidae

• *Amyciaea forticeps* (O. Pickard-Cambridge, 1873) (Bhattacharya *et al.*, 2017)
• *Angaeus pentagonalis* Pocock, 1901 (Barman, 1974)
• *Borboropactus elephantus* (Tikader, 1966) (Tikader, 1966a, b, 1971, 1980; Biswas & Majumder, 1995)
• *Camaricus formosus* Thorell, 1887 (Bhattacharya *et al.*, 2017; Roy *et al.*, 2017b)
• *Diaea subdola* O. Pickard-Cambridge, 1885 (Tikader, 1968, 1971, 1980; Biswas & Majumder, 1995)
• *Henriksenia hilaris* (Thorell, 1877) (Tikader, 1966a, 1971, 1980; Biswas & Majumder, 1995)
• *Indoxysticus minutus* (Tikader, 1960) (Tikader, 1968, 1971, 1980; Tikader & Biswas, 1981)
• *Lysiteles mandali* (Tikader, 1966) (Tikader, 1966a, b, 1971, 1980; Barman, 1974; Biswas & Majumder, 1995)

- *Massuria sreepanchamii* (Tikader, 1962) (Tikader, 1962a, 1971, 1980; Barman, 1974; Biswas & Majumder, 1995)
- *Misumena mridulai* Tikader, 1962 (Tikader, 1962a, 1971, 1980; Biswas & Majumder, 1995)
- *Misumena vatia* (Clerck, 1757) (Bhattacharya *et al.*, 2017)
- *Oxytate* sp. (Nakambam *et al.*, 2021)
- *Ozyptila khasi* Tikader, 1961 (Tikader, 1961, 1971, 1980; Biswas & Majumder, 1995; Saha *et al.*, 2016)
- *Runcinia insecta* (L. Koch, 1875) (Tikader, 1966a, 1971, 1980; Tikader & Biswas, 1981; Biswas & Majumder, 1995; Biswas & Biswas, 2006)
- *Runcinia roonwali* Tikader, 1965 (Tikader, 1968; Tikader, 1971, 1980; Biswas & Majumder, 1995)
- *Thomisus andamanensis* Tikader, 1980 (Roy *et al.*, 2017b)
- *Thomisus shillongensis* Sen, 1963 (Sen, 1963; Tikader, 1968, 1971, 1980; Biswas & Majumder, 1995)
- *Tmarus kotigeharus* Tikader, 1963 (Tikader, 1968, 1971; Barman, 1974)
- *Xysticus croceus* Fox, 1937 (Tikader, 1962a, 1968, 1971, 1980; Barman, 1974; Biswas & Majumder, 1995; Biswas & Biswas, 2006**)**
- *Xysticus joyantius* Tikader, 1966 (Tikader, 1966d, 1968, 1971, 1980; Biswas & Majumder, 1995)
- *Xysticus kamakhyai* Tikader, 1962 (Tikader, 1962a, 1971, 1980; Barman, 1974; Biswas & Majumder, 1995)
- *Xysticus khasiensis* Tikader, 1980 (Tikader, 1980; Biswas & Majumder, 1995)
- *Xysticus pynurus* Tikader, 196**8 (**Tikader, 1968, 1971, 1980; Biswas & Majumder, 1995)
- *Xysticus shillongensis* Tikader, 1962 (Tikader, 1962a, 1971, 1980; Biswas & Majumder, 1995)
- *Xysticus shyamrupus* Tikader, 1966 (Tikader, 1966a, 1971, 1980; Biswas & Majumder, 1995)

29. Uloboridae

- *Miagrammopes kirkeensis* Tikader, 1971 (Roy *et al.*, 2017b)
- *Uloborus khasiensis* Tikader, 1969 (Tikader, 1969b; Barman, 1974; Roy *et al.*, 2017b)

E. Mizoram

Mizoram is the southernmost state of northeast India, it extends from 21º56’ to 24º31’N latitudes, and from 92º16’ to 93º26’E longitudes sharing borders with Tripura in northeast, Assam in north, Manipur in northeast, Bangladesh in southwest and Myanmar in southeast. It covers an area of 21,087 km^2. Mizoram is a land of rolling hills of different heights with plains scattered here and there, valleys, rivers and lakes. Forest covers almost 90% area of the state. Bamboo is common in the state, typically intermixed with other forest vegetations. Like other northeast states, biodiversity of flora and fauna in Mizoram is very high. There are two national parks and six wildlife sanctuaries. Mizoram has 8 administrative districts: Aizawl, Champhai, Kolasib, Lawngtlai, Lunglei, Mamit, Saiha, and Serchhip (Fig. 6).

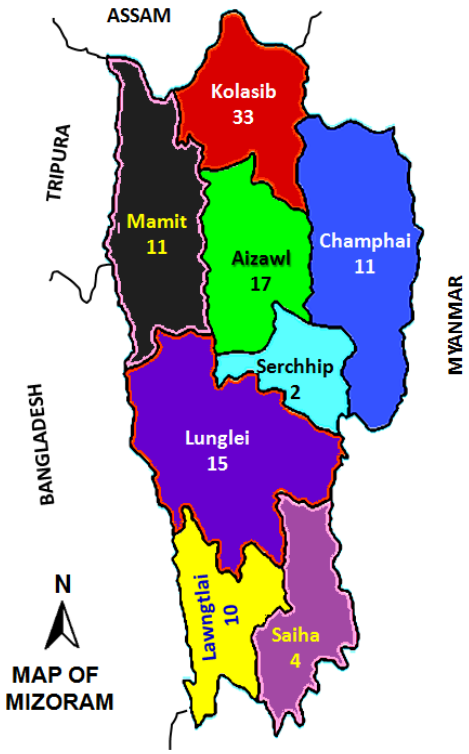

Fig. 6. Number of species of spiders described/recorded from different districts of Mizoram.

The faunal survey of spiders in Mizoram is very meager. Gajbe (1979) was probably the first who described a new species *Sosticus sundargarhensis* from Bungtlang located in Serchhip district. After a long gap, Biswas & Biswas (2007) conducted a faunal survey programme of Mizoram and listed 43 valid species out of which three species were new to science, e.g. *Larinia teiraensis* Biswas & Biswas, 2007, *Cheiracanthium aizwalense* Biswas & Biswas, 2007, and *Marpissa mizoramensis* Biswas & Biswas, 2007. Recently, another species, *Conothele giganticus* Siliwal and Raven, 2015 was described from Ngengpui Wildlife Sanctuary located in Lawngtlai district (Siliwal *et al.*, 2015b). In recent year, Chowdhury *et al.* (2017) conducted a survey of another district, Kolasib and enlisted 26 species of spiders.

In the present compilation, a total of only 70 species described under 49 genera belonging to 18 families were enlisted that have been recorded/described from Mizoram giving up-to-date information in the light of modern taxonomic concept. Scrutiny of the records mentioned in literature demonstrated that maximum number of species of spiders were recorded in Kolasib district (33 species) followed by Aizawl (17 species), Lunglei (15 species), Champhai and Mamit (11 species each), Lawngtlai (10 species), Saiha (4 species), and Serchhip (2 species) (Fig. 6). Only two species, *Gasteracantha diadesmia* Thorell, 1887 and *Nephila pilipes* (Fabricius, 1793) were widely distributed in 6 districts of Mizoram. Hence, intensive and extensive faunal survey is required in almost entire state, particularly in the southern regions. Following is the list of species of spiders recorded/described from different districts of Mizoram.

1. Araneidae

• *Araneus ellipticus* (Tikader & Bal, 1981) (Chowdhury *et al.*, 2017)
• *Araniella nympha* (Simon, 1889) (Chowdhury *et al.*, 2017)
• *Argiope aemula* (Walckenaer, 1841) (Biswas & Biswas, 2007)

• *Argiope pulchella* Thorell, 1881 (Biswas & Biswas, 2007)
• *Cyclosa confraga* (Thorell, 1892) (Biswas & Biswas, 2007; Chowdhury *et al.*, 2017)
• *Cyclosa spirifera* Simon, 1889 (Biswas & Biswas, 2007)
• *Gasteracantha diadesmia* Thorell, 1887 (Biswas & Biswas, 2007)
• *Gasteracantha kuhli* C.L. Koch, 1837 (Biswas & Biswas, 2007)
• *Gasteracantha unguifera* Simon, 1889 (Biswas & Biswas, 2007)
• *Herennia multipuncta* (Doleschall, 1859) (Biswas & Biswas, 2007)
• *Larinia teiraensis* Biswas & Biswas, 2007 (Biswas & Biswas, 2007)
• *Macracantha hasselti* (C.L. Koch, 1837) (Biswas & Biswas, 2007)
• *Neoscona bengalensis* Tikader & Bal, 1981 (Biswas & Biswas, 2007)
• *Neoscona inusta* (L. Koch, 1871) (Chowdhury *et al.*, 2017)
• *Neoscona mukerjei* Tikader, 1980 (Biswas & Biswas, 2007)
• *Neoscona nautica* (L. Koch, 1875) (Biswas & Biswas, 2007)
• *Neoscona vigilans* (Blackwall, 1865) (Chowdhury *et al.*, 2017)
• *Nephila kuhli* (Doleschall, 1859) (Biswas & Biswas, 2007)
• *Nephila pilipes* (Fabricius, 1793) (Biswas & Biswas, 2007)
• *Parawixia dehaani* (Doleschall, 1859) (Biswas & Biswas, 2007)
• *Trichonephila clavata* (L. Koch, 1878) (Biswas & Biswas, 2007)

2. Cheiracanthiidae

• *Cheiracanthium aizwalense* Biswas & Biswas, 2007 (Biswas & Biswas, 2007)

3. Ctenidae

• *Ctenus bomdilaensis* Tikader & Malhotra, 1981 (Biswas & Biswas, 2007)
• *Ctenus sikkimensis* Gravely, 1931 (Biswas & Biswas, 2007)

4. Gnaphosidae

• *Gnaphosa* sp. (Chowdhury *et al.*, 2017)
• *Sphingius barkudensis* Gravely, 1931 (Gajbe, 1979)

5. Halonoproctidae

• *Conothele giganticus* Siliwal & Raven, 2015 (Siliwal *et al.*, 2015b)

6. Ischnothelidae

• *Indothele dumicola* (Pocock, 1900) (Dhali *et al.*, 2016b)

7. Linyphiidae

• *Atypena adelinae* Barrion & Litsinger, 1995 (Chowdhury *et al.*, 2017)

8. Lycosidae

• *Draposa amkhasensis* (Tikader & Malhotra, 1976) (Chowdhury *et al.*, 2017)
• *Draposa oakleyi* (Gravely, 1924) (Biswas & Biswas, 2007)
• *Hippasa olivacea* (Thorell, 1887) (Biswas & Biswas, 2007)
• *Hippasa partita* (O. Pickard-Cambridge, 1876) (Biswas & Biswas, 2007)
• *Lycosa poonaensis* Tikader & Malhotra, 1980 (Chowdhury *et al.*, 2017)
• *Lycosa shillongensis* Tikader & Malhotra, 1980 (Biswas & Biswas, 2007)
• *Lycosa tista* Tikader, 1970 (Chowdhury *et al.*, 2017)
• *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Chowdhury *et al.*, 2017)
• *Pardosa rhenockensis* (Tikader, 1970) (Biswas & Biswas, 2007)
• *Wadicosa fidelis* (O. Pickard-Cambridge, 1872) (Biswas & Biswas, 2007)

9. Oxyopidae

• *Oxyopes javanus* Thorell, 1887 (Chowdhury *et al.*, 2017)
• *Oxyopes lineatipes* (C.L. Koch, 1847) (Chowdhury *et al.*, 2017)
• *Oxyopes ratnae* Tikader, 1970 (Biswas & Biswas, 2007)
• *Oxyopes shweta* Tikader 1970 (Biswas & Biswas, 2007)
• *Peucetia viridana* (Stoliczka, 1869) (Biswas & Biswas, 2007)

10. Pholcidae

• *Crossopriza lyoni* (Blackwall, 1867) (Biswas & Biswas, 2007)

11. Salticidae

• *Epocilla aura* (Dyal, 1935) (Biswas & Biswas, 2007; Caleb *et al.*, 2021)
• *Hasarius adansoni* (Audouin, 1825) (Chowdhury *et al.*, 2017)
• *Marpissa mizoramensis* Biswas & Biswas, 2007 (Biswas & Biswas, 2007)
• *Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869) (Chowdhury *et al.*, 2017)
• *Phidippus audax* (Hentz, 1845) (Chowdhury *et al.*, 2017)
• *Phintella vittata* (C.L. Koch, 1846) (Biswas & Biswas, 2007)
• *Rhene danieli* Tikader, 1973 (Chowdhury *et al.*, 2017)

12. Scytodidae

• *Scytodes fusca* Walckenaer, 1837 (Chowdhury *et al.*, 2017)

13. Sparassidae

• *Bhutaniella sikkimensis* (Gravely, 1931) (Biswas & Biswas, 2007)
• *Heteropoda kandiana* Pocock, 1899 (Biswas & Biswas, 2007)

14. Tetragnathidae

• *Glenognatha dentata* (Zhu & Wen, 1978) (Chowdhury *et al.*, 2017)
• *Leucauge celebesiana* (Walckenaer, 1841) (Biswas & Biswas, 2007)
• *Leucauge tessellata* (Thorell, 1887) (Biswas & Biswas, 2007)
• *Tetragnatha andamanensis* Tikader, 1977 (Biswas & Biswas, 2007)
• *Tetragnatha javana* (Thorell, 1890) (Chowdhury *et al.*, 2017)
• *Tetragnatha keyserlingi* Simon, 1890 (Chowdhury *et al.*, 2017)

15. Theraphosidae

• *Chilobrachys khasiensis* (Tikader, 1977) (Biswas & Biswas, 2007)

16. Theridiidae

• *Latrodectus hasselti* Thorell, 1870 (Biswas & Biswas, 2007)

17. Thomisidae

• *Camaricus formosus* Thorell, 1887 (Biswas & Biswas, 2007)
• *Ebrechtella concinna* (Thorell, 1877) (Chowdhury *et al.*, 2017)
• *Oxytate virens* (Thorell, 1891) (Chowdhury *et al.*, 2017)
• *Ozyptila* sp. (Chowdhury *et al.*, 2017)
• *Thomisus pugilis* Stoliczka, 1869 (Chowdhury *et al.*, 2017)
• *Xysticus croceus* Fox, 1937 (Biswas & Biswas, 2007)

18. Uloboridae

• *Miagrammopes gravelyi* Tikader, 1971 (Biswas & Biswas, 2007)

F. Nagaland

Nagaland is one of the northeast states of India bordered by the Arunachal Pradesh to the north, Assam to the west, Manipur to the south and the Myanmar to the east and covers an area of 16,579 km^2. It lies between the 98ºto 96ºE longitudes and 26.6º to 27.4ºN latitudes. It is largely a mountainous state, the important ones are the Naga Hills and Mount Saramati. Nagaland is inundated by three rivers, the Doyang and Diphu to the north, and the Barak river in the southwest. The evergreen tropical and subtropical forests cover about 20% of the total land area. Annual rainfall averages around 180-250 cm, intensed in the months of May to September. Temperatures range from 21 to 40°C in summer. The ecology of Nagaland favours rich diversity of flora and fauna. At present, Nagaland is divided into 12 administrative districts (Fig. 7).

Regarding the fauna of spiders, almost negligible account is available. Only two spiders were described from Nagaland, *Thelcticopis bicornuta* Pocock, 1901 and *Pancorius nagaland* Caleb, 2019. In addition, 5 more species were recorded from the state. Out of these, three species are distributed in Dimapur district and two species each in Peren and Tuensang districts. Following is the list of species of spiders recorded/described from different districts of Nagaland.

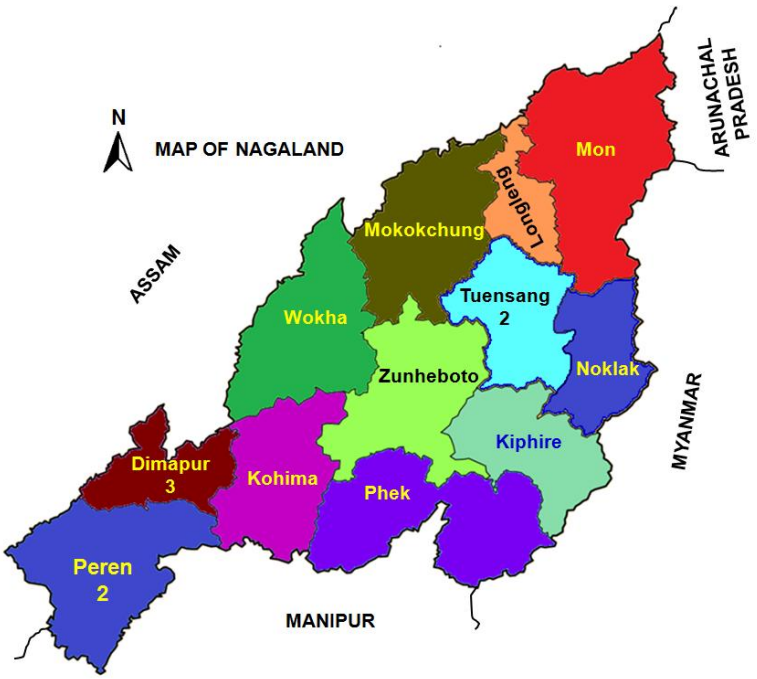

Fig. 7. Number of species of spiders described/recorded from different districts of Nagaland.

1. Araneidae

• *Cyrtophora unicolor* (Doleschall, 1857) (Pocock, 1900)

2. Lycosidae

• *Evippa rubiginosa* Simon, 1885 (Tikader & Malhotra, 1980)

3. Salticidae

• *Carrhotus sannio* (Thorell, 1877) (Caleb *et al.*, 2020)
• *Carrhotus viduus* (C.L. Koch, 1846) (Caleb *et al.*, 2020)
• *Pancorius nagaland* Caleb, 2019 (Caleb *et al.*, 2019)

4. Selenopidae

• *Selenops radiatus* Latreille, 1819 (Gravely, 1931)

5. Sparassidae

• *Thelcticopis bicornuta* Pocock, 1901 (Pocock, 1901)

G. Sikkim

As a part of the Eastern Himalaya, Sikkim is one of the states in northeastern India that has borders with the Tibet Autonomous Region of China in the north and northeast, Bhutan in the east, Nepal in the west, and West Bengal in the south, and lies between 27º5' to 20º9'N latitudes and 87º59' to 88º56'E longitudes, covering 7,096 km^2. Sikkim is characterised by having mountainous terrain and almost the entire state is hilly, hence unfit for agriculture. It hosts to Kangchenjunga, the highest peak in India (8,586 m). Almost 80% of the state is covered by forests including a National Park and six wildlife sanctuaries. Sikkim has five major hotsprings, several rivers, streams and waterfalls. Because of its altitudinal gradation, Sikkim has a wide diversity of flora and fauna within a small area. Sikkim has four administrative districts: East Sikkim, North Sikkim, South Sikkim, and West Sikkim (Fig. 8).

In spite of biodiversity hot spot, Sikkim received less attention regarding the biodiversity of spiders. Simon (1895, 1901, 1906) was the first to describe spider species such as *Runcinia bifrons* (Simon, 1895), *Phintella macrops* (Simon, 1901) and *Ajmonia velifera* (Simon, 1906) from unknown places of Sikkim. Later, Gravely (1931) described two species *Bhutaniella sikkimensis* and *Ctenus sikkimensis* from so called 'Sikkim', as the type localities of these spiders mentioned by him belong to the Darjeeling district of another Indian state, West Bengal, which lie few kilometers south from the border of Sikkim. In the recent century, only one species, *Pimoa thaleri* Trotta, 2009 was described.

Fig. 8. Number of species of spiders described/recorded from different districts of Sikkim.

In the present compilation, a total of only 89 species described under 55 genera belonging to 21 families were enlisted that have been recorded/described from Sikkim giving up-to-date information in the light of modern taxonomic concept. Scrutiny of the records mentioned in literature demonstrated that maximum number of species of spiders were recorded in West Sikkim district (56 species) followed by East Sikkim (15 species), and North Sikkim (2 species). No spider species was recorded in South Sikkim (Fig. 8). Hence, intensive and extensive faunal survey is required in almost entire state, particularly in the eastern, northern and southern districts. Following is the list of species of spiders recorded/described from different districts of Sikkim.

1. Agelenidae

- *Agelena barunae* Tikader, 1970 (Tikader, 1970; Saha *et al.*, 2016)
- *Agelena satmila* Tikader, 1970 (Tikader, 1970)
- *Tamgrinia alveolifera* (Schenkel, 1936) (Tikader, 1970)

2. Araneidae

- *Arachnura angura* Tikader, 1970 (Tikader, 1970, 1982; Saha *et al.*, 2016)
- *Argiope caesarea* Thorell, 1897 (Tikader, 1970)
- *Argiope pulchella* Thorell, 1881 (Tikader, 1970)
- *Cyclosa bifida* (Doleschall, 1859) (Tikader, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2006; Saha *et al.*, 2016)
- *Cyclosa confraga* (Thorell, 1892) (Tikader, 1982; Biswas & Biswas, 2007)
- *Cyclosa insulana* (Costa, 1834) (Tikader, 1970, 1982; Biswas & Majumder, 1995; Saha *et al.*, 2016)
- *Cyclosa quinqueguttata* (Thorell, 1881) (Tikader, 1982; Roy *et al.*, 2017a, b)
- *Cyclosa simoni* Tikader, 1982 (Tikader, 1982; Roy *et al.*, 2017a)
- *Cyrtophora bidenta* Tikader, 1970 (Tikader, 1970, 1982)
- *Cyrtophora moluccensis* (Doleschall, 1857) (Tikader, 1970, 1982; Saha *et al.*, 2016)
- *Gasteracantha diadesmia* Thorell, 1887 (Tikader, 1970, 1982; Biswas & Majumder, 1995; Saha *et al.*, 2016)
- *Gasteracantha kuhli* C.L. Koch, 1837 (Tikader, 1970, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2007; Saha *et al.*, 2016)
- *Gasteracantha unguifera* Simon, 1889 (Tikader, 1970, 1982; Biswas & Biswas, 2006; Saha *et al.*, 2016)
- *Macracantha arcuata* (Fabricius, 1793) (Tikader, 1982; Biswas & Majumder, 1995)
- *Macracantha hasselti* (C.L. Koch, 1837) (Pocock, 1900; Tikader, 1970, 1982; Tikader & Biswas, 1981; Biswas & Biswas, 2007)
- *Neoscona achine* (Simon, 1906) (Tikader & Biswas, 1981; Tikader, 1982; Biswas & Majumder, 1995)
- *Neoscona chrysanthusi* Tikader & Bal, 1981 (Tikader & Bal, 1981; Tikader & Biswas, 1981; Tikader, 1982)
- *Neoscona odites* (Simon, 1906) (Tikader & Bal, 1981; Tikader & Biswas, 1981; Tikader, 1982)
- *Nephila pilipes* (Fabricius, 1793) (Tikader, 1970, 1982; Biswas & Majumder, 1995; Majumder, 2005; Biswas & Biswas, 2006; Saha *et al.*, 2016)
- *Parawixia dehaani* (Doleschall, 1859) (Tikader, 1970, 1982; Tikader & Biswas, 1981; Majumder, 2005; Biswas & Biswas, 2007)
- *Poltys bhabanii* (Tikader, 1970) (Tikader, 1970, 1982)
- *Singa chota* Tikader, 1970 (Tikader, 1970; Tikader & Biswas, 1981)

• *Thelacantha brevispina* (Doleschall, 1857) (Tikader & Biswas, 1981; Tikader, 1982; Biswas & Majumder, 1995; Majumder, 2005)
• *Trichonephila clavata* (L. Koch, 1878) (Tikader, 1970, 1982; Biswas & Majumder, 1995; Biswas & Biswas, 2007; Saha *et al.*, 2016)

3. Cheiracanthiidae

• *Cheiracanthium indicum* O. Pickard-Cambridge, 1874 (Majumder & Tikader, 1991)
• *Cheiracanthium sikkimense* Majumder & Tikader, 1991 (Majumder & Tikader, 1991)

4. Ctenidae

• *Ctenus sikkimensis* Gravely, 1931 (Saha *et al.*, 2016)

5. Dictynidae

• *Ajmonia velifera* (Simon, 1906) (Simon, 1906)

6. Hahniidae

• *Hahnia mridulae* Tikader, 1970 (Tikader, 1970)

7. Linyphiidae

• *Lepthyphantes lingsoka* Tikader, 1970 (Tikader, 1970)
• *Lepthyphantes rudrai* Tikader, 1970 (Tikader, 1970; Saha *et al.*, 2016)
• *Linyphia sikkimensis* Tikader, 1970 (Tikader, 1970)

8. Lycosidae

• *Hippasa greenalliae* (Blackwall, 1867) (Tikader, 1970; Tikader & Malhotra, 1980; Biswas & Biswas, 2004)
• *Lycosa carmichaeli* Gravely, 1924 (Tikader, 1970)
• *Lycosa kempi* Gravely, 1924 (Tikader, 1970; Tikader & Malhotra, 1980; Biswas & Majumder, 1995)
• *Lycosa nigrotibialis* Simon, 1884 (Tikader & Malhotra, 1980; Biswas & Majumder, 1995)
• *Lycosa phipsoni* Pocock, 1899 (Sinha, 1951)
• *Lycosa tista* Tikader, 1970 (Tikader, 1970; Tikader & Malhotra, 1980; Biswas & Biswas, 2004)
• *Pardosa fletcheri* (Gravely, 1924) (Tikader, 1970; Tikader & Malhotra, 1980)
• *Pardosa kupupa* (Tikader, 1970) (Tikader, 1970; Tikader & Malhotra, 1980)
• *Pardosa rhenockensis* (Tikader, 1970) (Tikader, 1970; Tikader & Malhotra, 1980; Biswas & Biswas, 2007)

9. Oxyopidae

• *Hamadruas sikkimensis* (Tikader, 1970) (Tikader, 1970; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Biswas & Majumder, 1995)
• *Hamataliwa subhadrae* (Tikader, 1970) (Tikader, 1970)
• *Oxyopes ratnae* Tikader, 1970 (Tikader, 1970; Tikader & Biswas, 1981; Biswas & Biswas, 2007)
• *Oxyopes shweta* Tikader, 1970 (Tikader, 1970; Tikader & Biswas, 1981; Biswas & Majumder, 1995; Biswas & Biswas, 2006; Saha *et al.*, 2016)
• *Oxyopes sitae* Tikader, 1970 (Tikader, 1970, 1977; Biswas & Majumder, 1995; Saha *et al.*, 2016)
• *Oxyopes sunandae* Tikader 1970 (Tikader, 1970; Biswas & Majumder, 1995)

• *Peucetia latikae* Tikader, 1970 (Tikader, 1970; Biswas & Majumder, 1995)

10. Pholcidae

• *Crossopriza lyoni* (Blackwall, 1867) (Biswas & Biswas, 2007)

11. Pimoidae

• *Pimoa thaleri* Trotta, 2009 (Trotta, 2009)

12. Pisauridae

• *Dendrolycosa gitae* (Tikader, 1970) (Tikader, 1970, 1977; Saha *et al.*, 2016)
• *Hygropoda sikkimus* (Tikader, 1970) (Tikader, 1970, 1977)

13. Salticidae

• *Phintella macrops* (Simon, 1901) (Simon, 1901)
• *Phintella vittata* (C.L. Koch, 1846) (Tikader, 1967; Tikader & Biswas, 1981; Majumder, 2005)
• *Plexippus paykulli* (Audouin, 1825) (Tikader, 1967)
• *Pseudamycus himalaya* (Tikader, 1967) (Tikader, 1967)
• *Telamonia festiva* Thorell, 1887 (Tikader, 1967)

14. Sicariidae

• *Loxosceles rufescens* (Dufour, 1820) (Roewer, 1959)

15. Sparassidae

• *Bhutaniella sikkimensis* (Gravely, 1931) (Sethi & Tikader, 1988; Saha *et al.*, 2016)
• *Heteropoda leprosa* Simon, 1884 (Gravely, 1931; Sethi & Tikader, 1988)
• *Pseudopoda prompta* (O. Pickard-Cambridge, 1885) (Gravely, 1931; Sethi & Tikader, 1988)

16. Tetragnathidae

• *Leucauge celebesiana* (Walckenaer, 1841) (Tikader, 1970, 1982; Biswas & Majumder, 1995)
• *Leucauge decorata* (Blackwall, 1864) (Tikader, 1970, 1982; Biswas & Majumder, 1995; Saha *et al.*, 2016)
• *Leucauge tessellata* (Thorell, 1887) (Tikader, 1970, 1982; Biswas & Majumder, 1995; Saha *et al.*, 2016)
• *Orsinome vethi* (Hasselt, 1882) (Tikader, 1970)
• *Tetragnatha javana* (Thorell, 1890) (Tikader, 1970; Tikader & Biswas, 1981)
• *Tetragnatha mandibulata* Walckenaer, 1841 (Tikader, 1977b)
• *Tylorida ventralis* (Thorell, 1877) (Tikader, 1970, 1982)

17. Theraphosidae

• *Chilobrachys stridulans* (Wood Mason, 1877) (Hirst, 1909)

18. Theridiidae

• *Achaearanea budana* Tikader, 1970 (Tikader, 1970)
• *Achaearanea durgae* Tikader, 1970 (Tikader, 1970)
• *Argyrodes ambalikae* Tikader, 1970 (Tikader, 1970)
• *Argyrodes gazedes* Tikader, 1970 (Tikader, 1970)
• *Argyrodes gazingensis* Tikader, 1970 (Tikader, 1970)
• *Argyrodes projeles* Tikader, 1970 (Tikader, 1970)

• *Chrysso angula* (Tikader, 1970) (Tikader, 1970)
• *Chrysso urbasae* (Tikader, 1970) (Tikader, 1970; Saha *et al.*, 2016)
• *Theridion manjithar* Tikader, 1970 (Tikader, 1970; Prasad *et al.*, 2019)

19. Thomisidae

• *Epidius armatus* (Thorell, 1895) (Tikader, 1970, 1971, 1980)
• *Runcinia bifrons* (Simon, 1895) (Simon, 1895)
• *Thomisus rishus* Tikader, 1970 (Tikader, 1970, 1971, 1980)
• *Thomisus sikkimensis* Tikader, 1962 (Tikader, 1962a, 1970, 1980)
• *Xysticus roonwali* Tikader, 1964 (Tikader, 1971, 1980)
• *Xysticus sikkimus* Tikader, 1970 (Tikader, 1970, 1971, 1980)

20. Uloboridae

• *Uloborus krishnae* Tikader, 1970 (Tikader, 1970, 1977)

21. Zodariidae

• *Storenomorpha joyaus* (Tikader, 1970) (Tikader, 1970; Sankaran *et al.*, 2020)

H. Tripura

Tripura is one of the states in northeastern India and is bordered to the north, south, and west by Bangladesh, to the east by Mizoram and to the northeast by Assam. It extends from 22º56' to 24º32'N latitude, and 91º09' to 92º20'E longitude and covers 10,491.69 km^2 area. There are five mountain ranges, Boromura, Atharamura, Longtharai, Shakhan and Jampui Hills running north to south, with intervening valleys. Tripura has a tropical savannah climate, and receives seasonal heavy rains from the southwest monsoon. The average annual rainfall ranges between 200-275 cm. Several rivers originate from hills of Tripura. About half of the area is covered by forests generally interspersed with bamboo and cane tracts. The protected areas (wildlife and sanctuaries) cover a total of 566.93 km^2. The evergreen flora of Tripura favour high diversity of animals including arthropods. Presently, there are 8 administrative districts (Fig. 9).

In spite of being a biodiversity hot spot, like other northeast states, Tripura also received less attention regarding the biodiversity of spiders. Tikader & Biswas (1981) were the first to mention *Pardosa sumatrana* (Thorell, 1890) to be distributed in Tripura. Gajbe (1993) was first to describe a new species *Coillina yogeshi* (Gajbe, 1993) from Khowai district of Tripura. Biswas & Majumder (2000) were first to conduct a faunal survey of Tripura for spiders and recorded 26 species from different localities of Tripura. Another expedition was carried out by Dey *et al.* (2013) in West Tripura and recorded 41 valid species of spiders. Later, Mirza *et al.* (2017) described a species, *Macrothele alyrata* (Mirza *et al.*, 2017) from North Tripura district. Recently, Ahmed *et al.* (2020) recorded one more species from West Tripura and Das & Deb (2020) recorded 20 species from Unakoti district of Tripura.

In the present compilation, a total of only 79 species described under 53 genera belonging to 16 families were enlisted that have been recorded/described from Tripura giving up-to-date information in the light of modern taxonomic concept. Scrutiny of the records mentioned in literature demonstrated that maximum number of species of spiders were recorded in West Tripura district (48 species) followed by Unakoti (20 species), Dhalai (10 species), South Tripura (7 species), Kowai (3 species), Gomati (2 species) and North Tripura (1 species) (Fig. 9). Hence, intensive and extensive faunal survey is

required in almost entire state, particularly in the eastern, northern and southern districts. Following is the list of species of spiders recorded/described from different districts of Tripura.

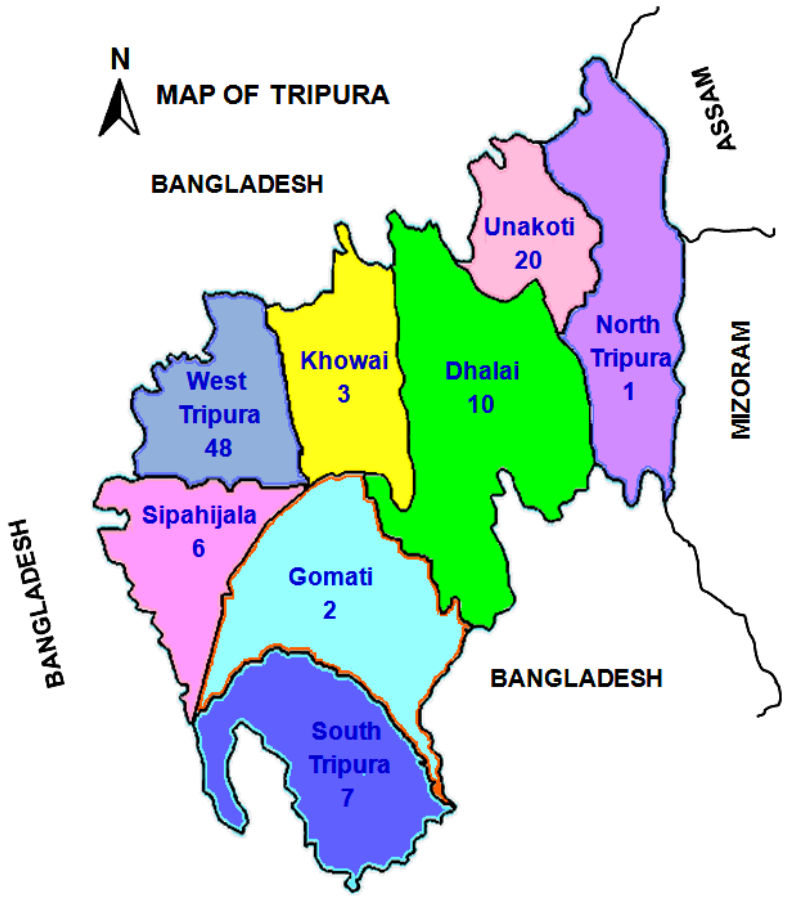

Fig. 9. Number of species of spiders described/recorded from different districts of Tripura.

1. Araneidae

• *Araneus mitificus* (Simon, 1886) (Dey *et al.*, 2013)
• *Argiope anasuja* Thorell, 1887 (Das & Deb, 2020)
• *Argiope minuta* Karsch, 1879 (Biswas & Majumder, 2000)
• *Argiope pulchella* Thorell, 1881 (Das & Deb, 2020)
• *Argiope versicolor* (Doleschall, 1859) (Dey *et al.*, 2013)
• *Cyclosa bifida* (Doleschall, 1859) (Dey *et al.*, 2013)
• *Cyrtophora cicatrosa* (Stoliczka, 1869) (Das & Deb, 2020)
• *Cyrtophora unicolor* (Doleschall, 1857) (Dey *et al.*, 2013)
• *Gasteracantha diadesmia* Thorell, 1887 (Biswas & Majumder, 2000)
• *Gasteracantha fornicata* (Fabricius, 1775) (Das & Deb, 2020)
• *Gasteracantha kuhli* C.L. Koch, 1837 (Biswas & Majumder, 2000; Das & Deb, 2020)
• *Gasteracantha unguifera* Simon, 1889 (Biswas & Majumder, 2000)
• *Gea subarmata* Thorell, 1890 (Biswas & Majumder, 2000)
• *Macracantha hasselti* (C.L. Koch, 1837) (Biswas & Majumder, 2000; Dey *et al.*, 2013)
• *Neoscona mukerjei* Tikader, 1980 (Biswas & Majumder, 2000)
• *Neoscona shillongensis* Tikader & Bal, 1981 (Biswas & Majumder, 2000)

• *Neoscona* sp. (Das & Deb, 2020)
• *Nephila kuhli* (Doleschall, 1859) (Dey *et al.*, 2013)
• *Nephila pilipes* (Fabricius, 1793) (Biswas & Majumder, 2000; Dey *et al.*, 2013; Das & Deb, 2020)
• *Parawixia dehaani* (Doleschall, 1859) (Biswas & Majumder, 2000)

2. Cheiracanthiidae

• *Cheiracanthium danieli* Tikader, 1975 (Dey *et al.*, 2013)

3. Clubionidae

• *Clubiona drassodes* O. Pickard-Cambridge, 1874 (Das & Deb, 2020)

4. Corinnidae

• *Castianeira* sp. (Dey *et al.*, 2013)

5. Gnaphosidae

• *Coillina yogeshi* (Gajbe, 1993) (Gajbe, 1993)

6. Hersiliidae

• *Hersilia savignyi* Lucas, 1836 (Das & Deb, 2020)

• *Hersilia* sp. (Dey *et al.*, 2013)

7. Lycosidae

• *Hippasa greenalliae* (Blackwall, 1867) (Dey *et al.*, 2013)
• *Hippasa holmerae* Thorell, 1895 (Biswas & Majumder, 2000)
• *Lycosa mackenziei* Gravely, 1924 (Dey *et al.*, 2013)
• *Lycosa nigrotibialis* Simon, 1884 (Biswas & Majumder, 2000)
• *Ocyale pilosa* (Roewer, 1960) (Biswas & Majumder, 2000)
• *Pardosa heterophthalma* (Simon, 1898) (Biswas & Majumder, 2000)
• *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) (Das & Deb, 2020)
• *Pardosa sumatrana* (Thorell, 1890) (Tikader & Biswas, 1981; Biswas & Majumder, 1995; Biswas & Biswas, 2004)
• *Pardosa sutherlandi* (Gravely, 1924) (Biswas & Majumder, 2000)

8. Macrothelidae

• *Macrothele alyrata* (Mirza, Sanap & Kunte, 2017) (Mirza *et al.*, 2017)

9. Oxyopidae

• *Hamadruas sikkimensis* (Tikader, 1970) (Biswas & Majumder, 2000; Gajbe, 2008)
• *Oxyopes birmanicus* Thorell, 1887 (Dey *et al.*, 2013; Das & Deb, 2020)
• *Oxyopes javanus* Thorell, 1887 (Dey *et al.*, 2013)
• *Oxyopes scalaris* Hentz, 1845 (Das & Deb, 2020)
• *Oxyopes shweta* Tikader 1970 (Biswas & Majumder, 2000; Gajbe, 2008)
• *Oxyopes sunandae* Tikader 1970 (Biswas & Majumder, 2000; Gajbe, 2008)

10. Salticidae

• *Asemonea* sp. (Dey *et al.*, 2013)
• *Brettus* sp. (Dey *et al.*, 2013)
• *Epeus* sp. (Dey *et al.*, 2013)
• *Marpissa muscosa* (Clerck, 1757) (Das & Deb, 2020)

• *Menemerus bivittatus* (Dufour, 1831) (Dey *et al.*, 2013)
• *Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869) (Dey *et al.*, 2013)
• *Myrmarachne melanocephala* MacLeay, 1839 (Dey *et al.*, 2013)
• *Phidippus punjabensis* Tikader, 1974 (Biswas & Majumder, 2000)
• *Phintella vittata* (C.L. Koch, 1846) (Biswas & Majumder, 2000; Dey *et al.*, 2013)
• *Phintelloides versicolor* (C.L. Koch, 1846) (Dey *et al.*, 2013)
• *Phlegra dhakuriensis* (Tikader, 1974) (Biswas & Majumder, 2000)
• *Plexippus paykulli* (Audouin, 1825) (Dey *et al.*, 2013; Das & Deb, 2020)
• *Plexippus petersi* (Karsch, 1878) (Dey *et al.*, 2013)
• *Portia labiata* (Thorell, 1887) (Dey *et al.*, 2013)
• *Rhene danieli* Tikader, 1973 (Dey *et al.*, 2013)
• *Rudakius ludhianaensis* (Tikader, 1974) (Biswas & Majumder, 2000)
• *Sandalodes superbus* (Karsch, 1878) (Das & Deb, 2020)
• *Siler semiglaucus* (Simon, 1901) (Das & Deb, 2020)
• *Siler* sp. (Dey *et al.*, 2013)
• *Telamonia dimidiata* (Simon, 1899) (Dey *et al.*, 2013)
• *Thiania bhamoensis* Thorell, 1887 (Dey *et al.*, 2013)
• *Thiania cf. suboppressa* Strand, 1907 (Ahmed *et al.*, 2020)

11. Scytodidae

• *Scytodes pallida* Doleschall, 1859 (Dey *et al.*, 2013)

12. Sparassidae

• *Bhutaniella sikkimensis* (Gravely, 1931) (Biswas & Majumder, 2000)
• *Heteropoda cervina* (L. Koch, 1875) (Dey *et al.*, 2013)
• *Heteropoda leprosa* Simon, 1884 (Biswas & Majumder, 2000)
• *Heteropoda venatoria* (Linnaeus, 1767) (Biswas & Majumder, 2000; Dey *et al.*, 2013; Das & Deb, 2020)

13. Tetragnathidae

• *Leucauge decorata* (Blackwall, 1864) (Dey *et al.*, 2013)
• *Opadometa fastigata* (Simon, 1877) (Dey *et al.*, 2013; Das & Deb, 2020)
• *Tetragnatha andamanensis* Tikader, 1977 (Biswas & Majumder, 2000)
• *Tetragnatha montana* Simon, 1874 (Das & Deb, 2020)
• *Tylorida* sp. (Dey *et al.*, 2013)

14. Theridiidae

• *Ariamnes* sp. (Dey *et al.*, 2013)
• *Chrysso* sp. (Dey *et al.*, 2013)

15. Thomisidae

• *Amyciaea lineatipes* O. Pickard-Cambridge, 1901 (Dey *et al.*, 2013)
• *Camaricus formosus* Thorell, 1887 (Dey *et al.*, 2013)
• *Camaricus maugei* (Walckenaer, 1837) (Dey *et al.*, 2013)
• *Xysticus croceus* Fox, 1937 (Das & Deb, 2020)

16. Uloboridae

• *Zosis* sp. (Dey *et al.*, 2013)

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Serket (2021) vol. 18(1): 145-151.

Element analysis of some harvestmen species in Turkey by the XRF methods (Arachnida: Opiliones)

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Abstract

With the three prominent functions such as osmotic, structural and biochemical, elements contribute to the adjustment of osmotic balance in tissues and cells and take charge in the texturing of essential molecules such as protein, nucleic acid, and fat. Elemental analysis of male and female individuals of *Giljarovia tenebricosa*, *Histricostoma caucasicum*, *Mitopus morio*, *Nelima pontica*, and *Odiellus zecariensis* species collected from different habitats in Turkey was performed by the XRF method. Based on the analysis results of the study, 16 inorganic elements; Ca, S, Cl, P, Mn, Zn, Fe, Cu, Na, Cr, Mg, Ni, K, Al, Ti, and Si, were detected. Statistically, significant variations were defined among the species in terms of the concentrations of Mg, Al, Si, and Ni elements ($p<0.01$). It was also determined that concentrations of K and Zn elements significantly varied in the male and female samples ($p<0.05$). Moreover, the concentrations of K and Zn elements were detected higher in females than in males.

Keywords: Elemental Analysis, Harvestmen, XRF Method, Turkey.

Introduction

The harvestmen (Opiliones), which constitute the third-largest order after spiders and acariformes in terms of species number, fall into the Arachnids (Arachnida) class of the Arthropods (Arthropoda) branch. So far, there are approximately 6882 taxa of this order identified in the world (Kury *et al.*, 2020).

An element is called a pure substance, which is consisted of the same kind of atoms and cannot be separated into a simpler than itself and different components by any

physical or chemical methods. With three important functions; osmotic, structural and biochemical, elements contribute to the formation of osmotic balance in tissues and cells and take charge in the texturing of essential molecules such as protein, nucleic acid, and fat. In addition, elements participate in the formation of various enzymes through binding themselves to particular proteins and play significant roles in the energy metabolism, redox reactions, and generation of NADP and ATP (Karabulut *et al.*, 2005).

There have been 118 elements identified so far. While 94 of these elements are present in nature, the rest are artificial elements synthesized under laboratory conditions. There are about 50 elements in the human body; 12 of them, Oxygen (O), Carbon (C), Hydrogen (H), Nitrogen (N), Calcium (Ca), Phosphorus (P), Potassium (K), Sulphur (S), Sodium (Na), Chlorine (Cl), Magnesium (Mg), and Iron (Fe), are called macro or quantitative elements, and the remaining are classified as micro or trace elements (IUPAC; Ayyüce, 2005).

XRF (X-ray fluorescence analysis) utilizes characteristic X-rays (called ‘‘fluorescence X-rays’’) emitted under high-energy. X-ray irradiation. XRF is one of the most important methods to enable the determination of elemental composition in agriculture, dental, forestry, medicinal herbs and their extracts (Bontempi *et al.*, 2008; Uo *et al.*, 2015). Nowadays, regarding the different applications of the XRF method, there are different types of fluorescence spectrometry such as EDXRF (Energy Dispersive X-ray Fluorescence Spectrometry), WDXRF (Wavelength Dispersive X-ray Fluorescence Spectrometry), HDXRF (High Definition X-ray Fluorescence Spectrometry), µXRF (Micro X-ray Fluorescence Spectrometry), MµXRF (Monochromatic Micro X-ray Fluorescence Spectrometry), MWDXRF (Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry), Confocal X-ray Fluorescence Spectrometry, and TXRF (Total Reflection X-ray Fluorescence Spectrometry).

The micro X-Ray Fluorescence (µXRF) used in the current study is the basic multi-purpose analysis technique, and it is used in the analysis of fractional samples in solid and liquid forms. This technique allows pointing, lining, and mapping scans on test pieces, and it measures elements within the specified line and displays them in colour. Furthermore, this technique requires no pre-processing such as coating, sectioning, and shuttering to perform the sample analysis. The micro XRF method is widely used in elemental mapping, detection of micro contamination, small particle analysis, forensic science, and as well as in measurements of small objects, filming, and coating thickness. Recently, it has been in use in many studies in the field of health services (Durdağı, 2018).

As it is considered an analytical tool, many researchers initially used the XRF technique in analyzing mineralogical and biological materials in several studies. However, this technique has recently been in use both for examining biological samples and elemental analysis in health services. Elemental analysis performed by the XRF method in biological materials is mostly carried out in plants, fishes, crustaceans, and insects. Bowden *et al.* (1979) determined the elemental composition of *Noctua pronuba* during migration using the WDXRF method. They stated that the concentrations of S, K, Ca, Cu, and Zn elements varied significantly among females. On the other hand, they reported that concentrations of S, Cl, K, and Ca were different between males and females. Karabulut *et al.* (2005) carried out the concentration of K, Ca, Fe, and Ni elements in three *Chrysomelida* species collected from the same habitat and detected that the Ni concentration in the elytra was significant. Dumlupınar *et al.* (2006) determined that concentrations of Cr, Zn, S, and Ca elements increased significantly; however, Mn and K decreased in the WDXRF elemental analysis performed during the hibernation period in *Drosophila melanogaster* species. Erman *et al.* (2006) identified a significant

difference between concentrations of Cu and Cs elements between males and females of *Agabus bipustulatus* species. In a study performed by Erman and Gürol (2007), the inorganic elements of *Laccophilus hyalinus* and *Laccophilus minutus* species, collected from four different provinces of Turkey, were measured with the WDXRF spectrometry. They identified 39 and 30 distinctive inorganic elements in *L. minutus* and *L. hyalinus* species, respectively. They also determined that concentrations of K, Ca, and Br elements significantly varied among these species. In addition, they stated that concentrations of Na, Mn, and Fe elements among males and females of *L. hyalinus* species; and Ge element between males and females of *L. minutus* species differed significantly. Bennett (2008) researched the elemental composition of at least six lichen species and determined their taxonomic importance. In addition, he stated that that data could be in use to differentiate other taxa. In a study performed with the XRF spectrometer by Erman (2011), 34 different inorganic element concentrations were determined among *Dytiscus thianschanicus* and *Dytiscus persicus* species collected from five cities of Turkey. He stated that there were variations both in elemental composition and quantity in the two mentioned species. He also indicated that the concentrations of Na, As, Br, and Ba elements varied significantly between species and reported that some chemical elements were in different concentrations between males and females. Erman & Korkut (2011) measured the concentrations of 49 different inorganic elements with the energy dispersive X-ray fluorescence (EDXRF) spectrometer in two *Agabus* species (*A. nebulosus* and *A. conspersus*) that belonged to the nebulosus group (*Dytiscidae*) and collected from Turkey (Adana province). They reported that the concentration of Mn element varied significantly between the two species. They also underlined that the identified variation could not be due to physicochemical reasons since the species were collected from the same locality; nevertheless, it could arise from genetic and biochemical characteristics between species. In a study to determine the concentration of some elements accumulated in the bodies of aquatic insects, Aydoğan *et al.* (2020) researched the inorganic contaminants by the EDXRF via utilizing predator diving beetles collected from, clean and polluted, six different cities in Turkey. In all species, 16 elements (Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, and Pb) were detected quantitatively. Magalhães *et al.* (2013) studied the chemical elements in invertebrate animal orders by instrumental neutron activation (INAA) method and determined Ba, Br, Ca, Fe, K, Na, Rb, Sc, Sr, and Zn elements in harvestmen specimens.

Material and Methods

The stored samples (specimens) in the GUSAL laboratory (Gümüşhane University Şiran Arachnology Laboratory) were removed from alcohol. The blotted samples were washed three times in distilled water and kept in an oven at 50°C to dry for 24 hours. Dried samples were placed in the appropriate capsules in the equipment, and the abdomen region of each sample was marked. Then, the analysis was performed in a calibrated Micro X-Ray Fluorescence (μ-XRF) (Eagle III, Roentgen Analytic System GMBH-CO. KG) spectrometer at 40 W, 20 kV. With the system software, the spectrum of samples was automatically analyzed, and the net density of the element peaks was determined. Statistical analyses were made in the SPSS-17 package program. Analysis of variance (ANOVA) and Duncan's multiple range test was used to determine significant differences among results. A Student’s test was used to know the statistical differences between gender (male and female).

Results and Discussion

The XRF elemental analysis was performed on male and female individuals of *Giljarovia tenebricosa*, *Histricostoma caucasicum*, *Mitopus morio*, *Nelima pontica*, and *Odiellus zecariensis* species collected from different regions of Turkey. These individuals were determined to contain 16 inorganic elements: Ca, S, Cl, P, Mn, Zn, Fe, Cu, Na, Cr, Mg, Ni, K, Al, Ti, and Si, respectively. Among the detected elements, while Ca was identified as the most abundant element among individuals, Ti was identified as the least abundant element (Table 1).

Table 1. The results of element analysis of studied harvestmen species (% concentration).

Element	*G. tenebricosa*		*H. caucausicum*		*M. morio*		*O. zecariensis*		*N. pontica*	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Na	12.01	11.26	2.94	3.76	13.58	8.51	9.30	11.42	14.13	7.85
Mg	6.67	7.27	0.51	1.75	6.25	5.34	2.50	4.77	7.30	6.27
Al	2.49	2.35	14.94	7.42	2.08	1.83	1.13	1.83	2.58	1.85
Si	2.90	2.72	183.85	118.91	1.81	1.73	2.95	11.10	2.17	0.75
P	29.64	17.87	30.82	28.08	42.79	21.79	40.90	133.17	48.05	28.59
S	82.01	63.85	39.51	96.95	102.96	83.76	63.89	112.71	141.17	105.14
Cl	125.85	114.43	149.02	106.17	75.90	92.78	48.19	83.62	107.87	90.07
K	14.11	4.71	4.77	2.74	19.91	5.19	25.69	16.46	22.71	2.93
Ca	538.33	294.95	266.93	180.21	599.61	313.12	709.16	827.83	606.29	223.04
Ti	1.04	1.88	1.59	0.95	1.11	2.77	1.43	1.48	0.74	1.19
Cr	9.76	93.67	4.84	9.05	9.17	6.58	4.01	8.11	7.87	7.75
Mn	49.19	30.19	14.41	15.02	54.51	33.39	23.19	67.61	48.59	18.25
Fe	49.41	30.13	36.17	14.19	32.65	25.19	28.29	38.29	43.03	14.31
Ni	7.09	7.96	3.44	3.45	5.45	7.19	5.14	6.80	5.06	5.67
Cu	16.65	15.70	11.27	12.09	13.18	13.35	14.06	12.68	16.15	11.45
Zn	30.56	17.97	18.44	7.75	40.85	21.25	56.43	25.85	56.38	15.36

In the samples subjected to the elemental analysis, there was a statistically significant difference among the species in terms of concentrations of Mg, Al, Si, and Ni elements ($p<0.01$). Concentrations of remaining analyzed elements such as Na, P, S, Cl, K, Ca, Ti, Cr, Mn, Fe, Cu, and Zn; however, identified as statistically insignificant among species ($p>0.05$). While *H. caucasicum* species contained the lowest Mg concentration, it was the highest in *G. tenebricosa* and *N. pontica* species. The concentration of Al and Si elements was higher in *H. caucasicum* than in other species. Furthermore, the concentration of these two elements (Al, Si) was determined low in *G. tenebricosa*, *N. pontica*, and *O. zecariensis* species. Although the concentration of Ni element was low in *G. tenebricosa*, *N. pontica*, and *O. zecariensis* species, it was at the lowest concentration in *H. caucasicum* species (Table 2).

Regarding the concentration of K and Zn elements, the gender difference was determined statistically significant ($p<0.05$). It was observed that the concentration of K and Zn elements was higher in females than in males (Table 3). Similarly, Erman (2011) had determined that Si and Zn concentrations were statistically significant in males and females of *D. persicus* species.

Karabulut *et al.* (2005) detected K, Ca, Fe, and Ni inorganic elements in 3 *Chrysomela* species and reported that; while the difference in Ni concentration in three species was statistically significant, the concentration of K, Ca, and Fe elements in the elytra of these three species were insignificant. Similarly, our study revealed that the concentration of Mg, Al, Si, and Ni elements showed a statistically significant difference among the five species (Table 2).

Table 2. Average element content of studied harvestmen species.

Element	*G. tenebricosa*	*H. caucasicum*	*M. morio*	*O. zecariensis*	*N. pontica*	Significant level
Na	11.63±0.53b	3.35±0.58a	11.04±3.59b	10.36±1.50b	10.99±4.44b	p>0.05
Mg	6.97±0.42c	1.13±0.88a	5.79±0.64bc	3.64±1.61b	6.79±0.73c	p<0.01
Al	2.42±0.10a	11.18±5.32b	1.96±0.17a	1.48±0.49a	2.22±0.51a	p<0.05
Si	2.81±0.13a	151.38±45.92b	1.77±0.06a	7.02±5.77a	0.46±0.41a	p<0.01
P	23.75±8.33a	29.45±1.94a	32.29±14.85a	87.04±65.25a	38.32±13.77a	p>0.05
S	72.93±12.84a	68.23±40.62a	93.36±13.58a	88.30±34.52a	123.16±25.48a	p>0.05
Cl	120.14±8.08b	127.59±30.30b	84.34±11.94ab	65.91±25.05a	98.97±12.59ab	p>0.05
K	9.41±6.65a	3.75±1.43a	12.55±10.41a	21.08±6.53a	12.82±13.98a	p>0.05
Ca	416.64±172.10ab	223.57±61.32a	456.37±202.58ab	768.49±83.91b	414.67±271ab	p>0.05
Ti	1.46±0.59a	1.27±0.45a	1.94±1.17a	1.45±0.04a	0.97±0.32a	p>0.05
Cr	51.71±59.33a	6.94±2.97a	7.87±1.83a	6.06±2.90a	7.81±0.08a	p>0.05
Mn	39.69±13.42a	14.72±0.43a	43.95±14.93a	45.40±31.41a	33.42±21.46a	p>0.05
Fe	39.77±13.63a	25.18±15.54a	28.92±5.27a	33.29±7.07a	28.67±20.31a	p>0.05
Ni	7.53±0.61b	3.44±0.00a	6.32±1.23b	5.97±1.17b	5.36±0.43ab	p<0.05
Cu	16.18±0.67b	11.68±0.58a	13.26±0.12ab	13.37±0.98ab	13.80±3.33ab	p>0.05
Zn	24.27±8.9a	13.10±7.56a	31.05±13.85a	41.14±21.62a	35.87±29.01a	p>0.05

a, b, c : Different letters in the same row indicate statistically significant (p<0.05).

Table 3. Average element content between male and female of studied harvestmen species.

Element	Female	Male	Significant level
Na	10.39±4.57a	8.56±3.12a	p>0.05
Mg	4.65±2.97a	5.08±2.09a	p>0.05
Al	4.64±5.78a	3.06±2.45a	p>0.05
Si	38.34±81.35a	27.04±51.52a	p>0.05
P	38.44±7.95a	45.90±48.99a	p>0.05
S	85.91±38.72a	92.48±19.27a	p>0.05
Cl	101.37±39.96a	97.41±12.57a	p>0.05
K	17.44±8.27b	6.41±5.72a	p<0.05
Ca	544.06±166.62a	367.83±262.71a	p>0.05
Ti	1.18±0.34a	1.65±0.71a	p>0.05
Cr	7.13±2.58a	25.03±38.38a	p>0.05
Mn	37.98±17.93a	32.89±20.90a	p>0.05
Fe	37.91±8.39a	24.42±10.40a	p>0.05
Ni	5.24±1.30a	13.05±1.64a	p>0.05
Cu	14.26±2.21a	13.05±1.64a	p>0.05
Zn	40.53±16.51b	17.64±6.77a	p<0.05

a, b, c : Different letters in the same row indicate statistically significant (p<0.05).

Bowden *et al.* (1979) stated that the concentration of S, K, Ca, Cu, and Zn elements in female individuals of *Noctua pronuba* species demonstrated significant differences; furthermore, the concentration of S, Cl, K, and Ca varied in males and females. Similarly, Erman (2011) reported that Si and Zn concentration was statistically significant in males and females of *D. persicus* species. Our current study also revealed

that there was a statistically significant difference for K and Zn concentrations between the two genders ($p<0.05$), and K and Zn concentrations were detected higher in females than in males (Table 3).

Magalhães *et al.* (2013) identified Ba, Br, Ca, Fe, K, Na, Rb, Sc, Sr, and Zn elements in harvestmen specimens by the INAA method. In this study, Ca, S, Cl, P, Mn, Zn, Fe, Cu, Na, Cr, Mg, Ni, K, Al, Ti, and Si elements were identified; however, Ba, Br, Rb, Sc, and Sr elements were not detected. It is considered that the variation in element composition may be due to differences in the method used and the habitats where the specimens were collected.

In the analysis performed with the EDS method in the exoskeleton structures of the arachnid whip scorpions, Gallant & Hochberg (2017) determined 12 and 10 elements in *Typopeltis dalyi* and *Mastigoproctus giganteus* species, respectively. The elements with the highest concentration in both species were Ca, Cl, and Zn. Similarly, the elements determined with the highest concentration in our study were Ca, Cl, and S. Some arachnids, insects, and millipedes are capable of strengthening their cuticle layers with Ca elements. It is considered that most of the arthropods accumulate calcium through nutrition and generates their own Ca reserves in environments where calcium is scarce (Vohland *et al.*, 2003; Gallant & Hochberg, 2017).

The elemental analysis data acquired in this study may not be considered as a taxonomic character in taxonomic studies. However, the data obtained from the chemical analyzes indicate significant differences which cannot be detected with other taxonomic characters, consequently, it may be beneficial. If the data provided with elemental analyzes support other taxonomic characters, this makes our future studies even more potent. Furthermore, elemental analyses may give us information about the feeding regime of the species, its habitat, and pollution and damage in its environment.

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Observations on defensive behaviour of the spider *Lachesana blackwalli* (Araneae: Zodariidae)

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Abstract

It has become increasingly popular to observe animal behaviour by video recording done by amateur naturalists. Here we report the first observed defensive behaviour of a male of *Lachesana blackwalli* (O. Pickard-Cambridge, 1872) (Araneae, Zodariidae) based on a video recorded by a non-specialist observer. The spider was encountered during a night walk, then it was disturbed by the observer, and its defensive behaviour was recorded. As the spider was disturbed by the observer, it displayed several conspicuous defensive responses such as death-feigning, lunging, and scaring. The main observed response was feigning death. This is the first documented defensive behaviour for *L. blackwalli*.

Keywords: Death-feigning, threat displays, *Lachesana blackwalli*, spider, Zodariidae.

Introduction

Natural selection in order to evade predation has resulted in a tremendous diversity of anti-predator traits including both morphological and behavioural ones. Prey species can increase their fitness (probability of survival) through various defensive mechanisms, which decrease their probability of being detected, attacked, or killed by a predator (Chelini *et al*., 2009). The prey animal can exhibit various threatening displays or anti-predator defensive behaviour. Such defence mechanisms can be divided into two

major groups: primary (or passive) and secondary (or active) (Cloudsley-Thompson, 1995; Pekár, 2014). Passive defensive behavioural mechanisms include anachoresis, crypsis, masquerade, aposematism, and mimicry, while active defences include fleeing, dropping, and death-feigning (thanatosis). A variety of passive defences has been described in spiders. For example, anachoresis, mimicry, and crypsis were observed for the species of Lycosidae, Zodariidae, Corinnidae, Salticidae, and Thomisidae, while dropping and death-feigning are known in some web-building species (Cloudsley-Thompson, 1995; Cutler, 1991; Nelson & Jackson, 2012; Pekár, 2014).

The spider family Zodariidae Thorell, 1881 is a rich taxon, which comprises 1211 species in 87 genera, found all over the world but predominantly in tropical and subtropical regions (World Spider Catalog, 2021). The members of this family are generally small to medium sized spiders and free living ground dwellers; many species have specialized diet consisting of ants or termites (Foelix, 2011).

The genus *Lachesana* Strand, 1932 includes ten species (World Spider Catalog, 2021) of a rather large size. *L. blackwalli* (O. Pickard-Cambridge, 1872) is the only known species of this genus found in Turkey; it is recorded from the sea level to about 2000 m in the high mountains (Özkütük *et al*., 2020). This species is also known from Greece, Cyprus, Israel, and Lebanon. While males may be found under the stones or are free living, wandering spiders, the females live among and underneath stones inside silk-lined vertical underground holes (Levy, 1990; Pekár & Lubin 2003).

The purpose of this contribution is to document the defensive behaviour of a threatened male specimen of *L. blackwalli*, which was encountered during a night walk by a hiker. We believe that this will make an important contribution to the natural history of *L. blackwalli*, a species that leads a cryptic life about which we have limited knowledge.

Material and Methods

The observer has noticed a large spider moving on the ground during a night walk at Çatalçam Village, Dursunbey District in Balıkesir Province at the Marmara region of Turkey. Out of curiosity, the observer decided to threaten the spider by touching it. The reactions of the spider were recorded with a mobile phone camera. Then, the specimen is placed in alcohol for storage and sent to the first author for identification; it was identified as male *Lachesana blackwalli* (O. Pickard-Cambridge, 1872). The specimen is stored in the Arachnology Laboratory of Bursa Uludağ University.

The recorded video is in MP4 format, 36 seconds long, with a low resolution. The video was watched many times to analyze the behaviour of the spider and the screenshots were taken by the authors for each represented type of behaviour. The clip is uploaded to the channel of the third author KBK under the title: "Defensive behaviour of the spider *Lachesana blackwalli*" to be available to researchers at: "https://youtu.be/CCSKIF0Z7aU".

Results

In many spiders, walking adult males are commonly observed during the mating season, usually crossing roads; they show conspicuous defensive displays when disturbed. In our case, the following defensive behaviours were displayed by a threatened male specimen of *L. blackwalli*:

Fig. 1. Screenshots showing defensive behaviour of *Lachesana blackwalli* from the video recording.

a. The first disturbance was made by the observer by touching the first right leg of the spider, the spider responded by falling to the ground, at the same time slowly vibrating all its legs and feigning-death. The duration of this behaviour was between 00:01-00:09 seconds of the recording.

b. The second disturbance was made by touching the first right leg of the spider again. The spider repeated the same response, feigning death with vibrating its legs slowly. The duration of this behaviour was between 00:09-00:14 seconds (Figs. 1a-c).

c. The third disturbance was made by touching the second right leg of the spider. The spider responded first by running rapidly, and then by lunging at the observer and demonstrating a defence position by spreading its first pair of legs forward on both sides. The duration of this behaviour was between 00:14-00:23 seconds (Figs. 1d-g).

d. The fourth disturbance was made by a cigarette butt, thrown by the observer in front of the spider's first legs. Faced with the cigarette butt, the spider rapidly raised its 3rd and 4th legs (Figs. 1h-j) and spread the first pair of legs upward on both sides to make itself look larger (Fig. 1k), exposing its ventral side. Finally, the spider fell on its back and feigned death (Fig. 1l). The duration of this behaviour was between 00:23-00:29 seconds.

e. The spider fell on its back, feigned death and remained completely motionless, as it was faced with danger to avoid or minimize the risk of predation. The duration of this behaviour was between 00:29-00:36 seconds (Fig 1l).

Discussion

As well as being important predators of insects, spiders themselves are a potential prey of many animals. It is well known that various spider species develop and exhibit diverse defence and protection strategies in order to survive. These strategies are exhibited both in spider behaviour and morphology.

In the observed video recording of *L. blackwalli*, the disturbed spider demonstrated two different types of defensive behaviour: a passive response by death-feigning (Figs. 1a-d, l) and an active response by threat displays (Figs. 1e-k).

An interesting behavioural trait observed in this spider was vibrating its legs during the first and second death-feigning until being completely motionless. These contractions in *L. blackwalli*, were slower than rapid rhythmic vibrations, which are known in other spiders, for example, in the species of the family Pholcidae. Another interesting type of behaviour was observed during the 00:25-00:26 seconds. At that point, the spider throws itself on its back in an instant after exhibiting an intimidating behaviour.

Death-feigning (thanatosis) has been observed in various spider taxa but is rarely reported. As a defensive mechanism, death-feigning can be viewed as a "last resort", occurring not only after the prey has already been detected by the predator but most often following a physical contact between the predator and its prey (Miyatake *et al*., 2004; Humphreys & Ruxton, 2018).

Clearly, more detailed observations of numerous specimens and populations are needed to see for which purpose and how often a species displays such a behaviour as described above for *L. blackwalli*. At the same time, a recording of the defensive behaviour of a cryptic spider species, which was obtained by chance, helps to direct further studies, indicating important details of predator-prey interactions.

Death-feigning appears to be both a major evolutionary trait and a great risk. An animal will feign death when that behaviour offers the best chance of success.

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Tetragnatha nitens (Savigny, 1825) (Araneae: Tetragnathidae) a new species for the spider fauna of Turkey

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Abstract

This study reports the first record of *Tetragnatha nitens* (Savigny, 1825) for the Turkish araneofauna. The spider *T. nitens* is recorded from İzmir Province, Turkey. Palp and epigyne illustrations of *T. nitens* are given.

Keywords: Spider, *Tetragnatha nitens*, new record, Turkey.

Introduction

Family Tetragnathidae is represented by four genera (*Meta*, *Metellina*, *Pachygnatha*, and *Tetragnatha*) and 15 species in Turkey. Seven species of *Tetragnatha* (*Tetragnatha extensa* (Linnaeus, 1758), *T. intermedia* Kulczyński, 1891, *T. montana* Simon, 1874, *T. nigrita* Lendl, 1886, *T. obtusa* C.L. Koch, 1837, *T. pinicola* L. Koch, 1870, and *T. striata* L. Koch, 1862) have been recorded from Turkey up to now (Danışman *et al*., 2021).

Tetragnatha nitens was described from Egypt by Savigny (1825) [for year of publication and authorship see El-Hennawy (2000)]. It is distributed in tropical and subtropical Asia (World Spider Catalog, 2021). Besides, it is reported as introduced species to the Americas, Macaronesia, Mediterranean, Madagascar, Pacific Is., New Zealand according to World Spider Catalog (2021).

In this study *Tetragnatha nitens* is recorded for the first time for the araneofauna of Turkey in İzmir province. Both genitalia of male and female are illustrated.

Figs. 1-9. *Tetragnatha nitens* ♂. 1. Habitus, dorsal view. 2-5. Left chelicera. 2. upper view. 3. inner view. 4. outer view. 5. lower view. 6-9. Left palp. 6. retrolateral. 7. ventral. 8. dorsal. 9. ventral view, enlarged.

Material and Methods

The specimens were collected from the bushes with sweeping net located along a small water stream in Urla District, İzmir. The specimens were preserved in 75% ethanol and deposited in Alaşehir Zoological Museum, Celal Bayar University, Alaşehir, Manisa, Turkey (AZMM/Ara-2017:1-9). They were examined by using Leica S8APO stereo microscope and identified using Levi (1981), Wunderlich (2011), Castanheira *et al*. (2019), and Najim (2019). All measurements are in millimetres.

Results

Taxonomy

Family **Tetragnathidae** Menge, 1866
Genus ***Tetragnatha*** Latreille, 1804
Tetragnatha nitens (Savigny, 1825)

Selected references:
Eugnatha nitens Savigny, 1825: 323, pl. 2, f. 2 (D♀).
Eugnatha pelusia Savigny, 1825: 325, pl. 2, f. 3 (D♂♀).
Tetragnatha gracilis Lucas, 1838: 43, pl. 6, f. 8 (D♀).
Tetragnatha nitens Walckenaer 1841: 209.
[See World Spider Catalog (2021) for complete list of references and synonyms.]

Material examined: 5♀♀, 4♂♂: Turkey, İzmir Province, Urla District, 5 km east of Zeytinler Village, 20.05.2017, 38º16'56"N, 26º37'19"E, 56 m, leg. Yağmur & Yılmaz.

Description

Male (Fig. 1): measurements (n=4)**:** carapace length 3.0-3.3, width 1.7-2.0; abdomen length 4.5-6.9, width 1.2-1.5; chelicerae length 3.1-3.5; chelicerae (Figs. 2-5) and carapace yellowish brown, carapace longer than wide, wider in the middle, fovea small. Sternum yellowish brown with dark edges. Chelicerae strongly diverging and protruding, prolateral margin with 9-10 strong teeth and retrolateral margin with 11 teeth; apically-retroventrally with a large tooth.

Abdomen has golden shine with white patches and longitudinal dark lines.

Palp (Figs. 6-9): palp tibia long and thin, paracymbium short, apically with a distinct notch and ventral transparent lobe, conductor twisted.

Female (Fig. 10): measurements (n=5)**:** carapace length 2.9-3.6, width 1.6-2.0; abdomen length 6.0-7.5, width 1.7-1.9; chelicerae length 3.0-3.8 (Figs. 11-14).

Epigyne (Figs. 15-16): epigynal area long and elongated with a posterior notch.

Habitat: The specimens were collected by sweeping net from bushes located along to a small water stream. The bushes were very dense located, and habitat was shady and cool (Fig. 17).

Figs. 10-16. *Tetragnatha nitens* ♀. 10. Habitus, dorsal view. 11-14. Left chelicera. 11. upper view. 12. inner view. 13. outer view. 14. lower view. 15-16. Epigynum, ventral view.

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Fig. 17. Collecting locality of *Tetragnatha nitens*, 5 km east of Zeytinler Village (Urla, İzmir).

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